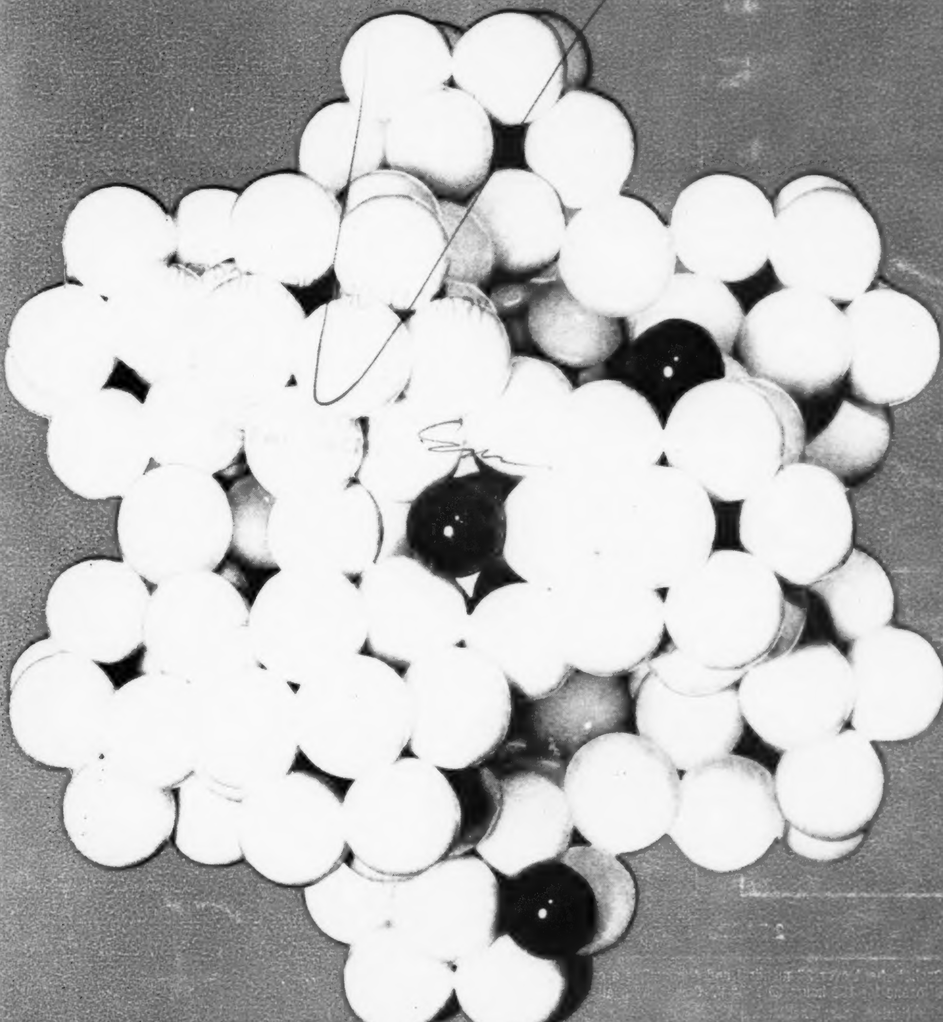
RUBBER WORLD



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RUBBER WORLD

VOLUME 143 NUMBER 4 JANUARY, 1961

CONTENTS

Cover: Photo courtesy of Linde Division, Union Carbide Corp. (see story on page 60)

SERVING THE RUBBER INDUSTRY SINCE 1889

A BILL BROTHERS PUBLICATION

FEATURE DEPARTMENTS

BILL BROTHERS PUBLISHING CORPORATION

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Editorial and Executive Offices:
630 Third Avenue, New York 17, N. Y.
YUkon 6-4800

BPA NBP

news of the rubber world

January, 1961

A new season begins for many of our Rubber Groups with the start of the new year. To the new officers of these Groups, RUBBER WORLD wishes to extend best wishes for continued and enlarged successful programs. The opportunities for technical information exchange, personal contacts with others, and the various social affairs are a very vital force in the growth of rubber chemistry and the industry in general.

New materials, processes, and equipment should continue to become available at a fast rate during 1961 as they have in the past. We do not feel qualified as crystal-ball gazers, but have provided in this issue (page 43) a round-up of the major developments of 1960 written by members of our Editorial Advisory Board covering their particular fields. These reports should assess current progress and provide an inkling as to some of the advances the new year might bring.

The first full year of production quantities of "synthetic natural" stereo rubbers is one title 1961 will get. With Shell Isoprene Rubber flowing, and the arrival on stream of the Phillips plant to produce Cis-4, sufficient material to make many items will be produced. Several other plants, mostly for polybutadiene, will soon swell total supplies.

Obtaining maximum information from small experimental samples of elastomers should be easier in the future if the testing procedure shown on page 54 is adopted.

Our product, RUBBER WORLD magazine, like other products, needs to be revised and improved from time to time to keep up with the changing times. We hope that you have enjoyed the "new look" introduced during the past year. More of this type of change to make the magazine more useful and readable will be made. The editorial staff is also being enlarged and realigned to permit us to serve you better.

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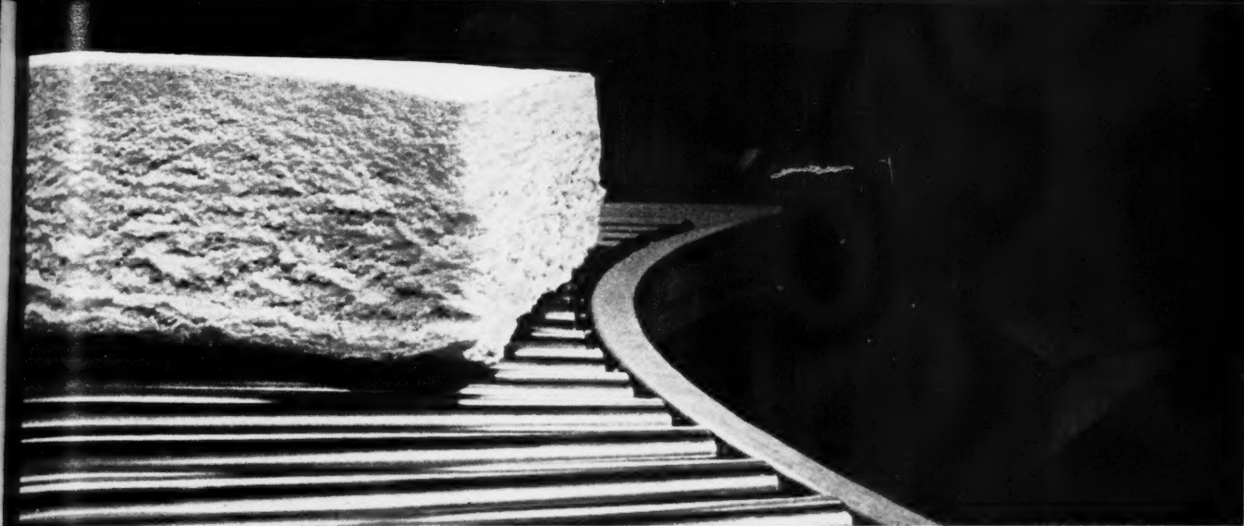


New Shell Isoprene Rubber. Note the white color. It accounts for exceptional brilliancy in finished products.

BULLETIN:

Shell Chemical announces increased production of Shell Isoprene Rubber—and tells how to get immediate shipments of this revolutionary new polymer

Shell Chemical has boosted polyisoprene capacity to over 3,000,000 pounds a month. This means carload lots are now available for immediate delivery.

Here is what you should know about new Shell Isoprene Rubber—the only commercially made polymer to unite the advantages of natural and synthetic rubber.

In 1959, Shell ended industry's 40-year search for a commercially made synthetic that would duplicate the *cis*-polyisoprene structure of natural rubber.

This year, Shell Chemical will be America's sole supplier of *polyisoprene* rubber. Over 3,000,000 pounds can be made a month for use in heavy-duty truck tires, surgical tubing, shoes, bathing caps, toys, rubber thread and hundreds of other products.

Properties never before possible

New Shell Isoprene Rubber possesses properties such as high resilience and low heat build-up that were never before possible in a synthetic polymer. Its mold flow is superior to natural rubber. It is uniform. Its color is *white*. And because Shell Isoprene Rubber is made by a chemically controlled process, it is ideal for items that demand exceptional purity.

Easy to process

This remarkable rubber can be blended with natural and most synthetic polymers in any proportion. And can be processed in conventional equipment.

New Shell Isoprene Rubber's processing characteristics, compounding formulations and vulcanization techniques are all similar to those of natural rubber. It can also be used with the same plasticizers, reinforcing agents, softeners, accelerators, vulcanization ingredients and coloring agents.

Shell Isoprene Rubber is available in carload lots or with mixed SBR loads from Shell's Torrance plant. Firms in the East and Midwest can now buy mixed loads of Shell Isoprene Rubber and various SBR polymers at standard truckload prices.

How to order

To order, call a Shell Chemical sales office in Stamford, Connecticut, DAvis 5-1581; Rocky River, Ohio, EDison 3-0600 or Lakewood, California, SPruce 3-4997.

Samples of Shell Isoprene Rubber and technical information are available. Write, Shell Chemical, P.O. Box 216, Torrance, California.

A Bulletin from

Shell Chemical Company

SHELL

Synthetic Rubber Division

technical books

BOOK REVIEWS

"International Rubber Directory." Walter Hirt, Editor. Cloth, 6 by 9 inches, 692 pages. Verlag fur Internationale Wirtschaftsliteratur GmbH., P. O. Box 108, Zurich 47, Switzerland. Price in the United States, \$17.00 plus postage (postpaid if remittance accompanies order).

This book is a complete guide to the rubber industry throughout the world. It lists every rubber product manufacturer with his major lines of products and location. There are 72 countries containing rubber companies represented in the book.

The book is divided into five sections. The first section is the listing of product manufacturers. This listing is broken down into continents, countries, and cities within the country. The information includes product line, number of employes, trade marks, brand names, subsidiaries, and affiliated companies.

The second section contains vocabularies of technical terms arranged first in German-English-French, then English-German-French, and finally, French-German-English order. Since the listings in the book may be in any one of the three languages, this section will prove very useful.

The third section is the buyers' guide and contains detailed descriptions for product line and foreign representatives classified both by countries and by product for all suppliers of raw materials to the rubber industry.

The fourth section is a listing of proprietary names used in the industry throughout the world.

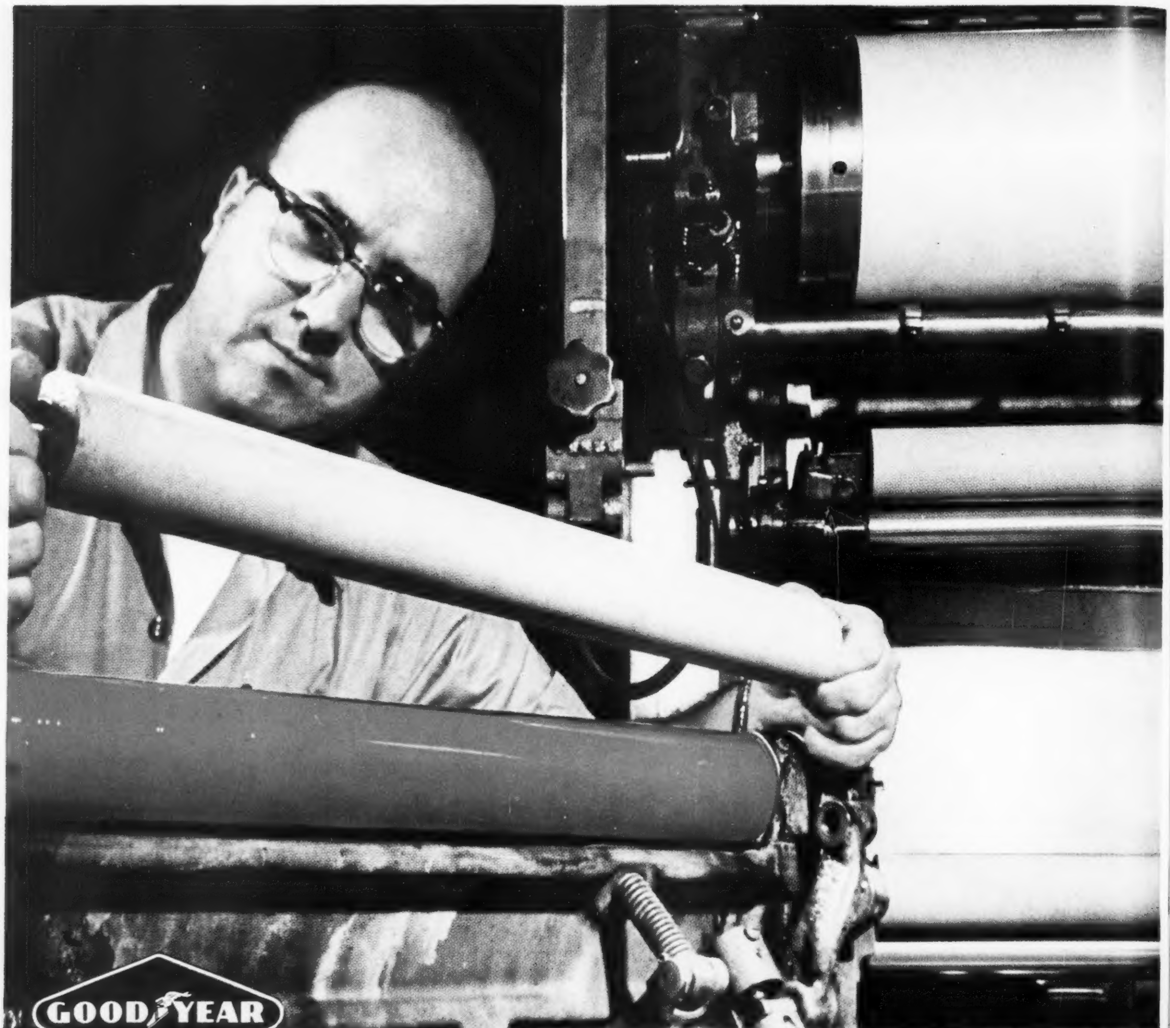
The final section is an alphabetical listing of all of the firms contained in the book.

This book should be a very valuable tool for anyone concerned with worldwide rubber industry or any major part of it and is quite interesting even to those whose interest might be academic or personal.

"Rubber Red Book." Directory of the Rubber Industry. Thirteenth edition. M. E. Lerner, Editor. $8\frac{1}{4} \times 11\frac{1}{4}$ inches, 814 pages. Palmerton Publishing Co., New York 1, N. Y. Price, \$15.00.

To past users of the previous 12 editions of this directory, little need be said of the value to those in the rubber industry that this publication affords. In general, this edition is similar in make-up and content with the preceding edition. There are some minor changes which should prove beneficial. All suppliers to the industry are listed in one place this time rather than being scattered throughout the material sections. In addition, sales offices and phone numbers

(Continued on page 14)



Photograph taken through the cooperation of The Ideal Roller & Manufacturing Co. and Githens-Sohl Corporation, New York, N.Y.

They multiply inking roller life 16 times—with CHEMIGUM

Each new season used to call for new inking rollers on "job" printing presses. Glue composition rollers would swell, soften—even melt—in hot and humid weather. And they would shrink and harden in cool, dry weather. Valuable time was lost, printing quality varied.

A leading roller manufacturer found CHEMIGUM N-8 a year-round answer to the problem. CHEMIGUM N-8 effectively resists climatic changes. Its soft, smooth surface means proper ink pickup and release. Its oil- and solvent-resistance makes it more durable, easy to clean. What's more, CHEMIGUM is extremely easy to process, keeps costs down. And the new rollers last—not a season—but up to 4 years!

How can CHEMIGUM rubber or latex help you improve your product or enter a new market? Full details plus expert technical assistance are yours at Goodyear Chemical Division, Dept. A-9418, Akron 16, Ohio.

Lots of good things come from

GOODYEAR

CHEMICAL DIVISION

Chemigum—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

technical books

(Continued from page 10)

have been included where known, for extra convenience.

In the mind of this reviewer, the large size and the paper cover are still detrimental to the most valuable use of this book. The cover stock weight has been increased this year, but is still not sturdy enough for a book which may receive considerable use during the year. In many places, copies are passed on to subordinates or associates at the end of the year and a torn copy with damage to the index loses some of its usefulness. The large size makes it very difficult to keep the book in a handy place on the desk where a reference book of this type is most useful.

In balance, however, it is quite well done, and there is little question but what many people have been waiting for this delayed annual edition to appear.

NEW PUBLICATIONS

"Compounding Light-Colored Rubber Rolls." By Ralph F. Wolf and Robert R. Meltz. Hi-Sil Bulletin No. 23. Columbia-Southern Chemical Corp., Barberton, O. 22 pages. This article discusses compounding natural rubber, neoprene, NBR, and Thiokol in various hardnesses for light-colored rubber rolls.

"This Is Rubber in the '60s." The Rubber Manufacturers Association, Inc., New York, N. Y. 24 pages. This is the 1960 edition of the RMA survey of the rubber industry for the layman. Replacing the 1959 edition, "This Is Rubber Today," the booklet adds references to polyisoprene and urethane and brings production and consumption figures up to the end of 1959.

"Beckman DK Spectrophotometer Accessories." Bulletin 738. Beckman Instruments, Inc., Fullerton, Calif. 14 pages. This bulletin describes accessories to adapt spectrophotometers to requirements of flame photometry, fluorometry, reflectometry, spectroradiometry, colorimetry, solid phase studies, reaction rate studies, and turbidity observations.

"Basic Weight Classifier." Bulletin 3347-A. Exact Weight Scale Co., Columbus, O. 2 pages. This brochure describes a semi-automated weighing system combining scales with calculators and other equipment through use of a binary code. A high intensity light beam, projected through an optical system, indicates product weight on a frosted glass scale dial. The light beam activates from two to seven photoelectric cells, which generate electrical signals available to operate calculators, recorders, counters, signals, and similar control mechanisms.

technical books

Publications of the technical service division, Natural Rubber Bureau, Washington D. C.:

"Heveaplus M." Technical Bulletin No. 1. 22 pages. This publication describes the physical and chemical properties, processing, compounding, vulcanization and uses of Heveaplus MG and MM, two graft polymers of natural rubber in which the rubber molecules have attached side chains of methyl methacrylate.

"SP Rubber." W. P. Fletcher and H. C. Baker. Technical Bulletin No. 2. 26 pages. The bulletin describes the physical and chemical properties, uses and curing of Special Processing natural rubber, a mixture of vulcanized and unmodified rubber made by blending the rubbers in the latex form.

"Compounding Natural Rubber for Heat Resistance." W. P. Fletcher and S. G. Fogg. Technical Bulletin No. 3. 22 pages. This pamphlet discusses a system involving use of a "sulfurless" curing agent such as tellurium, tetramethylthiuram disulfide, or dicumyl peroxide, and selection of appropriate antioxidants and fillers.

"Compounding Natural Rubber for Service at Low Temperatures." S. G. Fogg and P. M. Swift. Technical Bulletin No. 4. 26 pages. This publication discusses use of proper plasticizers and vulcanizing systems for low-temperature rubbers, and also modification of natural rubber in order to create an anti-crystallizing rubber.

Publications of Smooth-On Mfg. Co., Jersey City, N. J.:

"Cold-Setting Flexible Mold Compounds, Smooth-On FMC." Bulletin No. 2. 4 pages. This bulletin outlines general procedure for using "Smooth-On" FMC polysulfide rubber in applications where ease or speed of separation from a complex model is desirable.

"Smooth-On FMC No. 201 (Black)." Technical Bulletin 12C. 4 pages. This bulletin describes the two-component liquid system for making cold-set synthetic rubber molds, consisting of a combination of liquid polymers and a curative, the two to be mixed immediately prior to pouring. Specific directions for using and a list of cured characteristics with two types of curative agents are given.

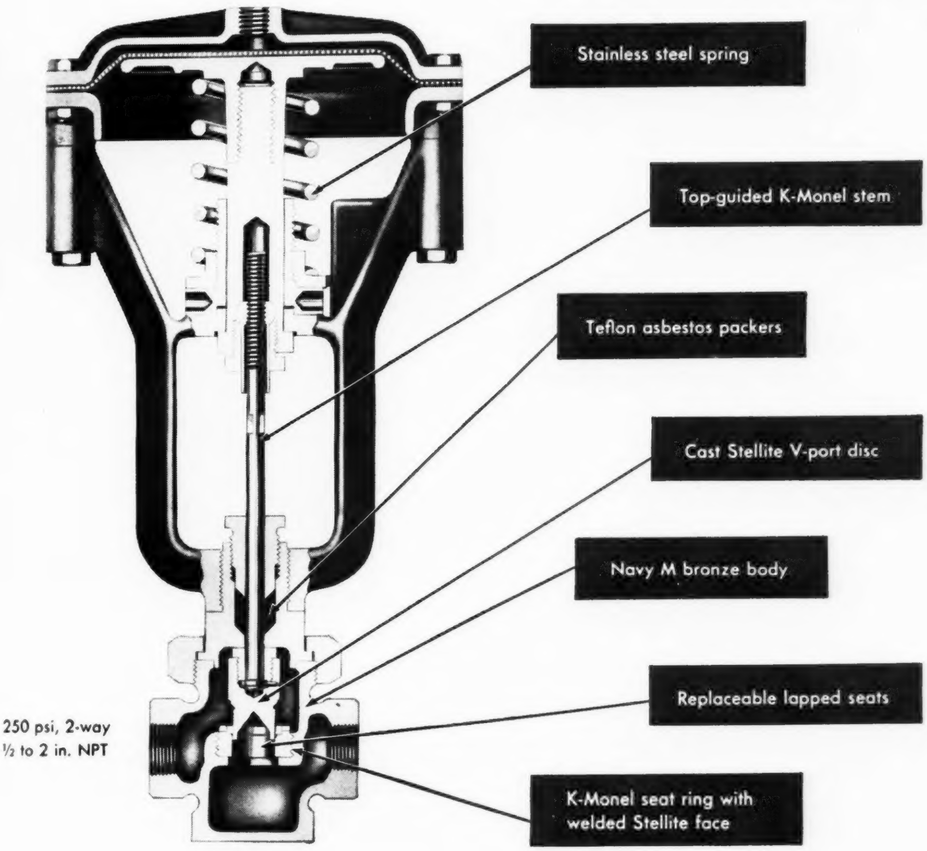
Publications of Testing Machines, Inc., Mineola, L. I., N. Y.:

"The Wallace Micro-Hardness Tester for Rubber and Rubber-Like Materials." 4 pages. This pamphlet describes operation of the tester, which permits direct measurement of the hardness of such small molded components as O-rings and small seals without molding standard-size test specimens from the material used.

"The Wallace Electronic Micro-Indentation Tester." 4 pages. This folder covers operations and applications of the instrument, used for testing a range of materials from very soft to very hard.

"Measurement of the Hardness of Surface Coat-

SINCLAIR-COLLINS® V-PORT VALVES



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Find out how S-C V-port valves can meet your control needs . . . a call to your near-by Sinclair-Collins Field engineer will bring prompt application engineering recommendations.

For more information write for free Bulletin SC-59. Address: Sinclair-Collins Valve Company, Akron 9, Ohio, Dept. RW-161.

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technical books

ings by Means of the Wallace Electronic Micro-Indentation Tester." 6 pages. The bulletin describes use of the tester to measure indentation under load and degree of recovery of the material as a measure of the hardness of the coating, usable for coating as thin as 0.0005-inch, according to the bulletin.

Publications of the British Rubber Producers' Research Association (now the Natural Rubber Producers' Research Association), Welwyn Garden City, Herts, England:

"Determination of Degree of Cross-Linking in Natural Rubber Vulcanizates. Part IV. Stress-Strain Behavior at Large Extensions." By L. Mullins. No. 342. 7 pages.

"Failure of Foamed Elastic Materials." By A. N. Gent and A. G. Thomas. No. 344. 4 pages.

"Extensometer for Semi-Rigid Materials." By C. D. Kinloch and N. E. Waters. No. 345. 3 pages.

"Reactions of Thiols with Tetra-Alkylthiuram Disulphides and Related Compounds." By B. Saville. No. 346. 4 pages.

"The Attack of Ozone on Stretched Rubber Vulcanizates. Part I. The Rate of Cut Growth. **Part II.** Conditions for Cut Growth." By M. Braden and A. N. Gent. No. 347. 17 pages.

"New Methods of Cross-Linking Natural Rubber. Part I. The Introduction of Carboxylic Acid and Ester Groups into Natural Rubber and Their Subsequent Utilization for Cross-Linking." By J. I. Cunneen, C. G. Moore, B. R. Shephard. No. 348. 9 pages.

"Cis-trans Isomerisation in Polyisoprenes. Part VI. Production of Crystallization-Inhibited Natural Rubber by Treatment with Butadiene Sulphone." By J. I. Cunneen, P. McL. Swift, W. F. Watson. No. 349. 12 pages.

"Radiation Cross-Linking of Rubber. Part IV. Ultraviolet and Infrared Absorption Spectra." By M. B. Evans, G. M. C. Higgins, and D. T. Turner. No. 350. 5 pages. **"Part V.** Yields of Hydrogen and Cross-Links." By D. T. Turner. No. 343. 14 pages.

"Flexible Urethane Foam—'Genetron' Auxiliary Blowing Agents." Genetron department, General Chemical Division, Allied Chemical Corp., New York, N. Y.

"Scissors, Shears, Snips, Tweezers." Clauss Cutlery Co., Fremont, O.

"Mox-Tape." Moxness Products, Inc., Racine, Wis. 4 pages. This bulletin describes Moxness unsupported silicone rubber tapes.

"Goulds Centrifugal Pumps." Bulletin 720.5. Goulds Pumps, Inc., Seneca Falls, N. Y. 4 pages.

"Rapistan Permanent Inclined Belt Conveyors." Bulletin 400. Rapids-Standard Co., Grand Rapids, Mich. 6 pages.

"Four New Electronic Temperature Controllers and Indicators." Bulletin MC-190. Fenwal, Inc., Ashland, Mass. 8 pages.

"Bailey Electrical Control Systems." Bulletin E74-1. Bailey Meter Co., Cleveland, O. 4 pages.

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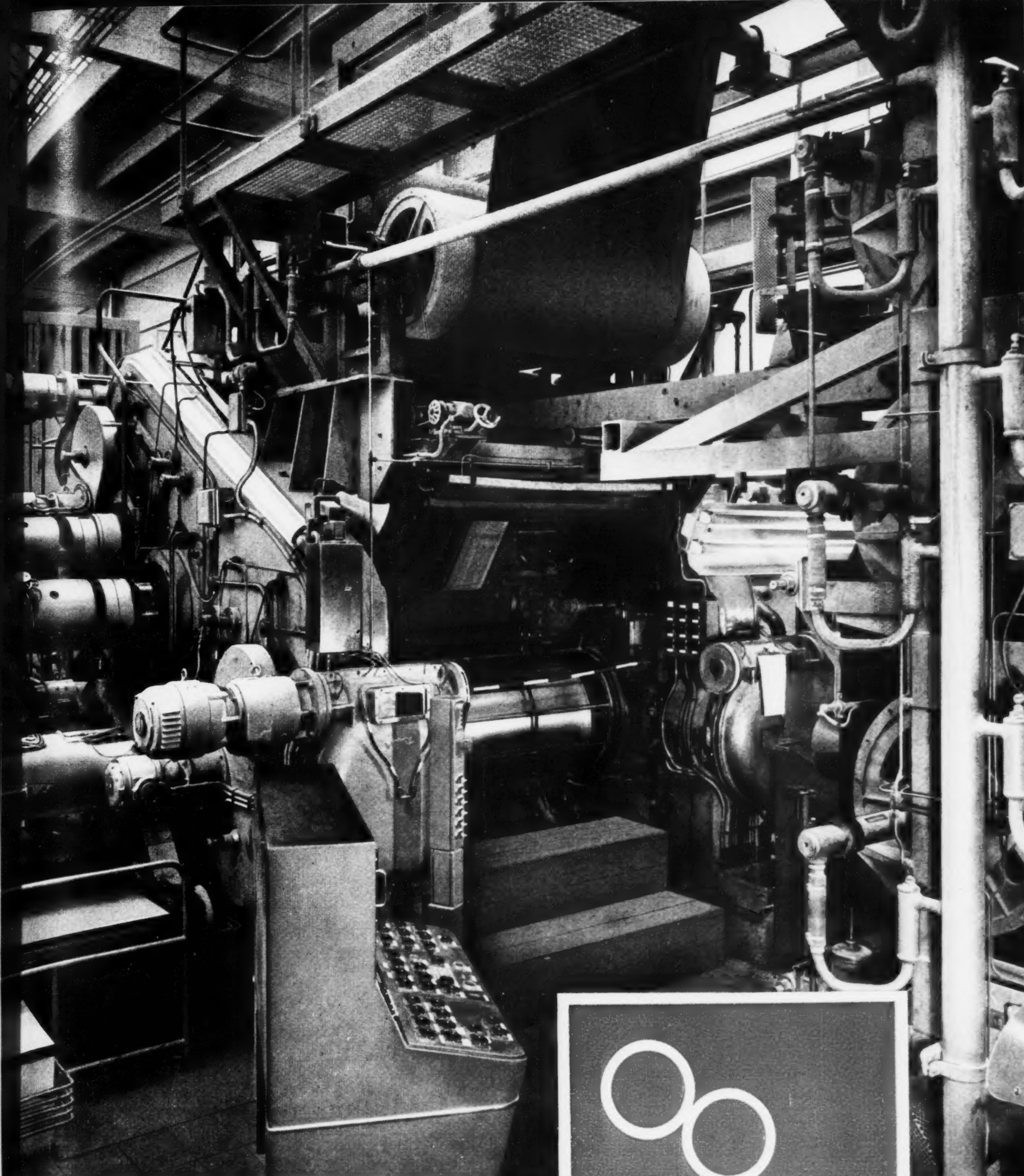
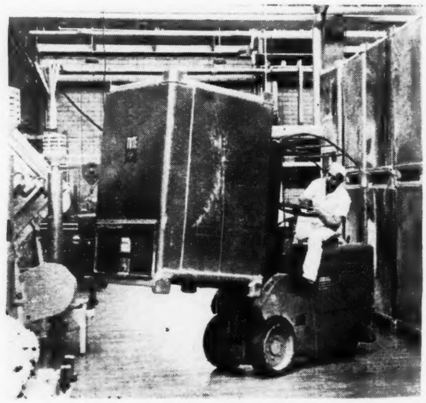


new equipment



Operator loads Tote Bin, which serves as shipping container, storage unit, and discharge hopper for dry goods or liquids

Magnesium Tote Bins

Magnesium Tote Bins, said by the manufacturer to be about 40% lighter than the standard aluminum bins, are being offered by Tote System, Inc., Beatrice, Neb., at the same price as its aluminum containers. The Tote Bins, in dry product capacities ranging from 42 to 100 cubic feet, and liquid capacities of 300 and 400 gallons, are also manufactured in carbon and stainless steel. Special sizes or special alloys are made to order.

The Tote Bin serves as shipping container, storage unit, and discharge hopper. About 75% of all Tote Bins sold are aluminum, but the new pricing policy is expected to increase popularity of the magnesium bin because more payload can be delivered while still remaining within highway load limits, the manufacturer says.

Ozone Recorder

Mast Development Co., Davenport, Iowa, has introduced a portable ozone recorder, Model 725-3B, which weighs 58 pounds. It has an operating range of 0 to 100 pphm/volume, a sensitivity of ±2% of full scale, a sampling rate of 140 cc/min., and a response time of 75% of true value in one minute, according to the manufacturer. The power requirement is 110 volts alternating current.

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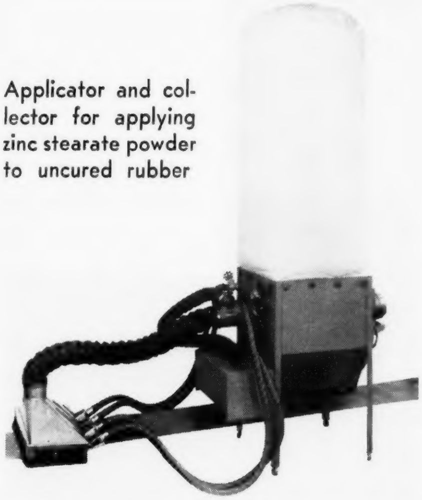


Applicator and collector for applying zinc stearate powder to uncured rubber

Zinc Stearate Unit

G. F. Goodman & Son, Philadelphia, Pa., has introduced a powder dispenser and collector for applying zinc stearate to uncured rubber. The machine is used to apply the powder to strips and sheets of rubber as they come from a calender or slabs of rubber as they come from a mill.

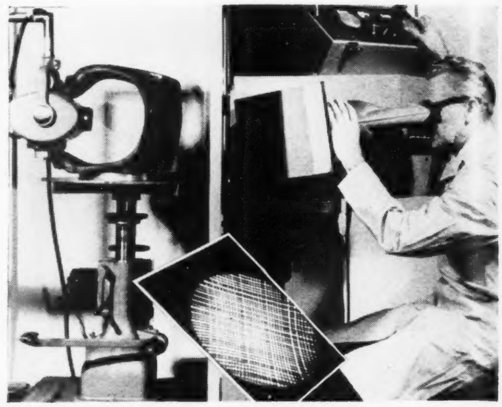
The unit is mounted on top of or beside a conveyor belt carrying the uncured rubber. This unit consists of a nylon filter bag 24 by 24 by 60 inches in size, attached to a self-cleaning paddle-type pressure blower. The unit has a capacity of 400 cubic feet per minute with a loaded bag. This is attached to a suction connection and duct of five-inch diameter.

The storage chamber is filled about half full with zinc stearate. As the unit is started, the pressure blower draws through the five-inch-diameter suction duct and directs a blast of air down upon the agitated zinc stearate, creating a dust-laden atmosphere within the machine. Four fittings attached to the side of the machine receive the low-pressure powder-laden air and carry it through hoses to the point of discharge.

A suction hood placed at the point of discharge has stainless-steel nozzles at its forward edge that distribute the powder evenly across the surface of the work. Each nozzle will cover a section about seven inches wide. A five-inch flexible duct from the suction hood returns excess powder back into the machine.

The manufacturer says the dispenser has the advantage over present dispensers that it maintains good control over the rate at which powder is applied to the work, and that it returns the excess to the storage hopper. In addition, this device is self-contained and does not require the use of air compressors, collectors, or pumps.

new equipment



U. S. Rubber tire engineer studies truck tire with new fluoroscope being used for the first time in the rubber industry, which permits inspection of the internal structure of tires. Inset shows view of steel cords in section under examination

Fluoroscopes Tires

United States Rubber Co. is using a new type of industrial fluoroscope at its tire division plant in Detroit that scans the internal structure of tires. The instrument, developed by Picker X-Ray Corp., White Plains, N. Y., has an amplifying screen 1,000 times brighter than a conventional fluorescent screen.

The machine gives a continuous picture of the insides of a tire because the tire under examination can be rotated between the instrument's X-ray source and its screen. This reveals structural variations that may be present in the tire which would not be evident in a static X-ray picture.

The new fluoroscope is being used to examine tires before and after vulcanization to study the way they respond to different assembly techniques and to gain a fuller understanding of tire characteristics that affect smoothness of ride. The company feels that the machine will make unnecessary many of the present quality controls, and may eventually lead to automatic inspection of tires.

High Torque Extruders

Prodex Corp., Fords, N. J., has announced a new series of HT high torque extruders, designed to deliver the highest possible production rates from any given size of extruder. The HT series of extruders has gear transmissions capable of delivering as much torque as the screw can safely handle, the manufacturer says. The new gear transmissions are equipped with change gears to permit selection of the optimum reduction ratio and gear speed.

In addition, the screw shank on the new extruder line has been redesigned to handle the highest possible torque. The new machines have safety glass inspection covers for thrust housings, and a new


NOTE
REMOVAL OF THIS PLATE
PERMITS INSTALLATION
OF AUTOMATIC TIMER
AND SWITCH.
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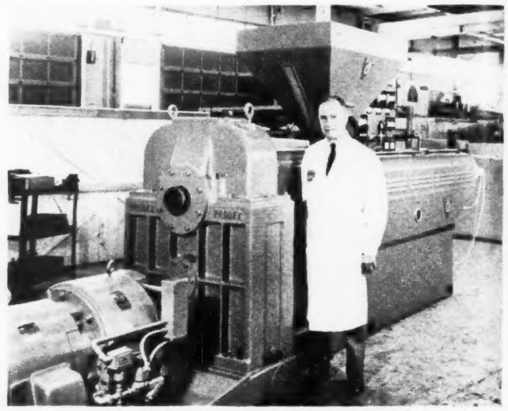
INSTRUCTIONS

seal has been introduced at the screw shank to avoid leakage of powders and to permit the use of vacuum hoppers.



New Prodex extruder

Laboratory worker checks new vertical planetary mixer introduced by Chemical Machinery Division of Baker Perkins

Planetary Lab Mixer

A new vertical planetary mixer for laboratory use has been introduced by the Chemical Machinery Division of Baker Perkins, Inc. The mixer, a replica of the company's heavy-duty production machine, is reportedly the smallest of its type available for laboratory use. Like the larger mixer, it can be adapted for internal-pressure mixing with some design changes.

Materials to be mixed are held in a stationary stainless-steel jacketed container. Actual mixing is done by double planetary motion of two stainless-steel agitator blades, operating at a differential of 2:1.

In charging and discharging materials and clean-

(Continued on page 32)


No loose black
No bulk oil
No unpigmented rubber

new materials

New Carbomix Masterbatches Listed

Two new masterbatch SBR polymers have been added to the list of available rubbers by Copolymer Rubber & Chemical Corp., Baton Rouge, La.

The first, Carbomix 1609 (introduced as 3762), is a cold black masterbatch. It is based on a 1500-type latex and contains a staining stabilizer. Soap type is rosin-acid. The masterbatch contains 40 parts of SAF carbon black and 5 parts of highly aromatic oil as process oil.

The other, Carbomix 3761, is a cold oil-black masterbatch. It also is based on 1500-type latex, but includes a non-staining stabilizer. Soap type is rosin-acid. This masterbatch contains 75 parts of SRF carbon black and 17.5 of naphthenic extender oil.

Dow Corning 981 Silicone Varnish

A new Class H varnish that cures at 150° C. in just six hours has been announced by Dow Corning Corp., Midland, Mich. Designated Dow Corning 981, the new material is as easy to process as most Class A and Class B varnishes, thus eliminating the need of high-temperature curing ovens in producing Class H electrical equipment. Like the first low-temperature-curing silicone varnish which was introduced by the company a year ago, this new dipping and impregnating varnish meets AIEE requirements for both 180 and 220° C. systems.

Extensive tests indicate that despite the lower curing temperature, 50° C. below that required for most other silicone varnishes, the new varnish has greater heat stability than any other varnish known, it is claimed. Run-off is also substantially lower than that for other varnishes, assuring appreciable savings in reduced waste, equipment maintenance, and clean-up time.

"Rulon" Spray Mold Release

"Rulon" spray, a reinforced fluorocarbon anti-stick and mold release agent is now available from Dixon Corp., Bristol, R. I., in six-ounce aerosol spray cans. The spray is said to dry instantly, leaving no gummy or oily film and to last for several cycles. It is chemically inert, insoluble, and thermally stable to over 500° F., the company claims, and "Rulon" spray can be used in all molding applications for natural and synthetic rubbers and plastics and where painting, plating, or hot stamping follows molding.

Liquid silicone rubber in spray form has been introduced by G-E

RTV-60—Silicone Rubber Spray

Liquid RTV (room-temperature vulcanizing) silicone rubber in aerosol spray form has been introduced by the silicone products department, General Electric Co., Waterford, N. Y.

The new product, RTV-60, is a red liquid silicone rubber suggested for use where thin, thermal, protective, shock absorbent or non-conductive coatings are desired, such as on electronic assemblies and parts.

The product is said to have the properties of conventional liquid silicone rubber. The manufacturer says it has good physical and electrical properties, is resistant to temperatures from —65 to 600° F., is resistant to many solvents, unaffected by ozone, and exhibits good bonding ability. Cure time varies from 15 minutes to several hours, depending on amount and type of catalyst used.

Planetary Lab Mixer

(Continued from page 28)

ing, the mixing container of the mixer can be raised or lowered by a hand-control, powered by an air cylinder governed by a reducer coupled to the mixer's quarter-horsepower air motor. Air connections to the mixer, motor, and other elements are behind or on top of the unit to give the laboratory engineer freedom of action.

Metal Parts Cleaner

Pall Corp., Glen Cove, N. Y., has introduced a new cleaning unit to be used with Pall-Clean chemical solutions, which are used to clean stainless steel, Monel, nickel and aluminum surfaces, plus carbon steel and brass. The cleaner contains no moving parts and needs only a water inlet and drain connection and a source of 208-240-volt alternating current.


ROEBLING

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No. 13

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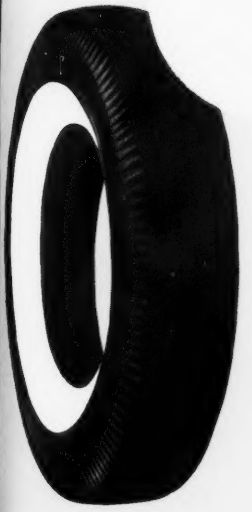


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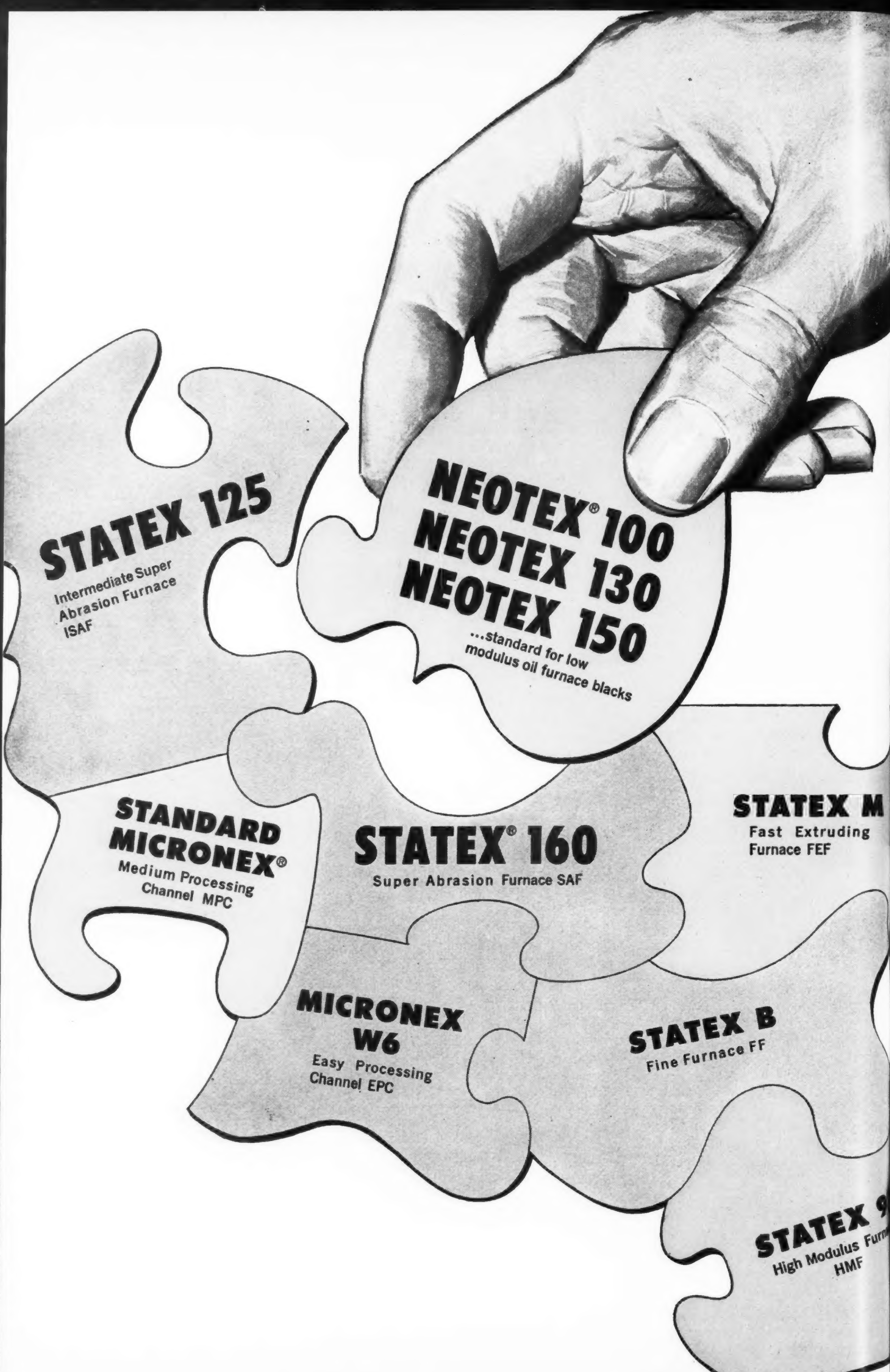

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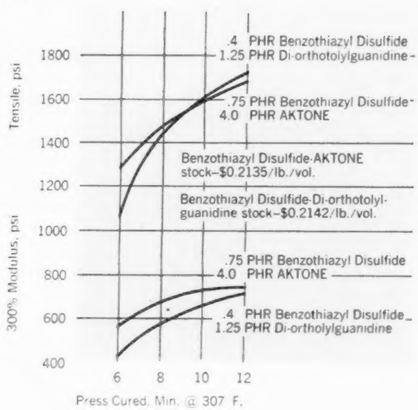

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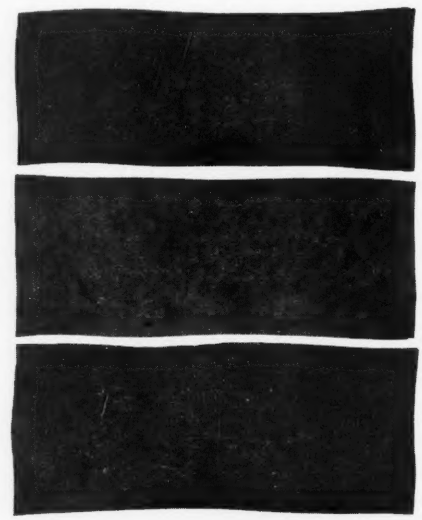
PRODUCT "B"



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WORLD

editorial

1961—A Year of Challenge

We have now entered into the new year of 1961. As is traditional, we are in a period of evaluation of our past performance and an attempt to predict what the future holds. We should evaluate ourselves as individuals; we should evaluate our company; and we should evaluate our industry.

There is little question now but that the reports of a year ago on the "Golden," "Glowing," "Soaring," or other highly optimistic adjectives prefixed to the Sixties were not fulfilled in the first year of the decade. Perhaps we expected too much too soon. The year 1960 was not a real "bad" one for the rubber industry overall even if it did not set too many records. The outlook for the future is for continued growth. Many companies, having faith in this growth, have followed through on expenditures for new plant and equipment.

Among those problems which must be resolved by the rubber industry is a cooperative attitude toward meeting competition of other materials. Traditionally, the rubber compounder has hidden his formulas behind a top-secret label. This attitude is understandable since these compounds are the essential ingredient in keeping his products competitive. It is unfortunate, however, that this same veil of "secrecy" is applied to almost every facet of rubber manufacture including problems which need solution. Many, many times technical service men have complained that rubber product manufacturers are reluctant to disclose anything more than generalities.

We must, in every way possible, seek to share with the rest of the industry our experiences, problems, and general know-how to put rubber in the forefront in growth in the coming years. We must seek to minimize backbiting among ourselves and set our sights on new products, new methods, new machinery, and new outlooks to push rubber into new applications, hold current applications, and retake applications lost to other materials.

Another major problem which needs immediate attention is in the field of education. The general public must be made more aware of what rubber can do, is doing, and may do in the future. Public relations programs must be stepped up by every individual and company to make known to the public at large how great an effect the primarily industrial rubber products have on their welfare. But of even greater importance is the need of better information, more courses, and increased emphasis on rubber in existing courses for today's students. A look into textbooks for grammar school, high school, and college students will yield precious little practical information on rubber. Engineers today study metals, fabrics, ceramics, oil, concrete, and even plastics, but few are afforded an opportunity to learn something about our product.

Our customers, bless 'em, are often uninformed or misinformed as to the properties of rubber and how to get the product they need. Anyone processing inquiries from customers for rubber parts can cite many examples of excessively close tolerances or quality requirements which add nothing to the rubber product but cost. Some efforts to alleviate this situation have been made, particularly by The Rubber Manufacturers Association, Inc., but recent comments from RUBBER WORLD readers indicate this is still a problem.

RUBBER WORLD resolves for 1961 to do all in its power to lead the way in a combined effort to meet these and other problems and hopes that each of you increases your business in the coming year.

R. S. Walker

EDITOR

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A 1960 REVIEW Of Products and Technology

THE 1960's, we are told, will be marked by the more intense competition for the sales dollar than the decade just past. For this reason the upward trend in expenditures for industrial and market research and development, so evident during the 1950's, has undoubtedly continued during the past year.

RUBBER WORLD considers it extremely appropriate at this time, therefore, to try to collect information on some of the new developments in the rubber and related products industry and its technology that had taken place during 1960. To this end the members of our editorial advisory board and others were asked to contribute brief reviews for their particular fields of activity, which include many major product lines and some raw materials, as well as rubber science.

In the series of reviews which follows, the most recent developments in tires, industrial and mechanical rubber goods, footwear, soles and heels, wire and cable, reclaimed rubber, latex, and the physics of rubber have been covered. The information presented deals not only with product and material developments, but processing, technology, and, in some instances, the market situation.

These reviews should be of more than usual interest at the end of a year of rapid change and at the beginning of a year that promises to continue to record development advances in the various fields at a rapid rate.

J. H. Fielding

Tires

By J. H. FIELDING

Armstrong Rubber Co., West Haven, Conn.

IN THE tire industry, 1960 was an exciting year. It was big in the number of tires processed. It was marked by the continuation of some previous trends, by the establishment of some new trends, and by the coming of age of many developments of previous years. Overall, however, it was a year of decreased profit.

Production of passenger cars was high; therefore a large number of original equipment tires were made. Also, replacement tires, both passenger and truck, were produced in greater numbers in 1960 than in 1959. Other factors, however, contributed to the reduction in profits in the tire industry in 1960. The increasing preference for compact cars brought with it a shift to greater production of smaller sizes of tires, which meant less tonnage in a specific number of tires. There was also evidence of price competition both direct and through a new emphasis on third-line nylon tires and second-line snow tires.

In this competitive environment there was evidence of efforts to make tires better and cheaper.

Rubber Usage and Trends

Natural rubber rose to a high price level late in 1959 and held at a high level through most of 1960. This factor influenced the profit picture as the continued need for natural rubber was felt in 1960. The use of natural rubber in tires dropped only slightly from 34.6% in 1959 to 33.1% in the second quarter of 1960. This trend made it more and more evident that something

other than SBR would be needed to penetrate some of the few remaining uses of natural rubber in tires.

Probably the most exciting development in rubber chemistry in the past few years has been in the field of stereoregular polymers. In 1960, interest in these stereoregular rubbers was accelerated. One plant making polyisoprene has come into full production, and plans for constructing a second larger plant by the same company have been announced. Others have announced plans for production plants in conjunction with similar announcements concerning polybutadiene. By the year's end and after a rather sharp drop in the price of natural rubber, price competition between stereoregular and natural rubbers became quite evident, and polyisoprene has already been faced with the necessity of a reduction in price.

Greater technical interest seems to be directed toward polybutadiene, and the small amount of polybutadiene production during 1960 found ready customers. In some cases it may have been used because it was cheaper than natural rubber. It is quite likely, however, that the bulk of it was used because of its specific technical qualities. Plans for polybutadiene production plants have been announced by four companies, and definite pilot-plant activity has been indicated by four more. Two of these plants, which are under construction, should be in production early in 1961.

These *cis* polymers of polyisoprene and polybutadiene were not a factor in the increased use of synthetic rubber during 1960, but it is expected they will be in years to come.

Halogenated butyl rubber was advanced last year when a production plant to produce chlorobutyl came on stream. This material bridges the gap in adhesion and compatibility between butyl and NR or SBR.

SBR black masterbatch, which increased sharply in production in 1959, held its own during 1960. Its use appears to have leveled off at about 25% of SBR production on a gross basis or 17% on a net base polymer basis. Most masterbatches are now dispersant-free, and most of them are either oil-extended or contain some added oil.

There seems to be a further trend toward the use of greater amounts of oil-extended SBR. This is probably a matter of economics, but it may have been helped by a feeling that the quiet or soft ride tread made with this type of rubber was desirable.

Other Trends

As might be expected, the increased use of oil-extended SBR has brought with it an increased use of SAF and ISAF blacks. It seems, however, that the use of these blacks has increased even more than the amount that could be attributed to oil-extended SBR alone, and no doubt the reason is a desire to produce higher-quality tires.

The use of GPF black in tires also has increased, no doubt for economy reasons since it is a smooth processing black at lower cost.

The losers in the field were channel black and FEF. Channel, of course, is faced with rising gas costs as more and more gas finds its way into pipelines. It was boosted in price last year. It is expected that the downward trend in the use of channel black will continue for some years to come, and that it will ultimately disappear as a tire black. The use of FEF black has dropped, presumably in favor of lower priced GPF.

Several new blacks in the general class of low modulus furnace blacks have been brought out. Various of these have specific aims such as a contribution to soft ride, substitute for channel black, and one is SRF black made entirely from oil instead of gas.

The battle between nylon and rayon tire cord has continued with a series of price reductions. The reduced cost coupled with the desire on the part of the public for greater safety plus other attributes associated with the name nylon has resulted in a substantial increase in the number of nylon tires included in the so-called third line. In the midst of this activity there has been speculation as to what the next high-quality tire fiber will be, with interest in Dacron being revived.

In the production of tires there has been a still further extension of more modern manufacturing methods, which, in many cases, have involved the use of some degree of automation. In previous years it might have been said that fewer and fewer pot heaters were in use for tire curing. Now it may be said that fewer and fewer curing bags are in use in connection with press-cured tires. Even the semi-automatic bladder-type curing press is giving way very rapidly to the fully automatic bladder-type press with automatic post inflation. This latter development brings about a cost saving as a result of increased production efficiency and also provides the opportunity to improve the quality of the product.

Post inflation, *per se*, is becoming almost universal in the production of both passenger and truck tires. In most cases the use of this new technique is for the purpose of producing a quality product with better wearing tread materials in designs having intricate features intended to accomplish some specific purpose. Post inflation has the advantage of allowing more latitude in tread design and in compound formulation. In some cases post inflation is used merely as a means of cost reduction through up-sizing.

The butyl tire was highly advertised in 1960 and has apparently reached a good production level. One tire manufacturer has entered the field in his own name with premium-line butyl tires.

There have been other varied announcements regarding the development of quieter or softer riding tires. Siping, which is the introduction of narrow slots in the tread ribs during vulcanization, has been used to an increasing extent in passenger-car tires and now in truck tires. In the passenger-car tires, siping provides for improved traction and wear and a quieter ride. In truck tires the quieter ride may not be evident, but the improved traction and wear are.

It appears in review that the excitement in 1960 in the tire manufacturing industry has been in getting a job done, in adapting ourselves quickly and efficiently to trends over which we have no control, and in bringing to production level many of the developments of previous years.

Mechanical Rubber Products

By J. J. ALLEN
Firestone Tire & Rubber Co., Akron, O.

J. J. Allen

THE manufacturers of non-tire products, which include industrial and mechanical rubber products, used approximately 36% of the total rubber consumed in the U. S. A. in 1960. This figure includes natural rubber, all types of synthetic rubber, and reclaimed rubber. There was a small reduction in the consumption of natural rubber, with a corresponding increase in the use of synthetic rubber and reclaimed rubber. The total consumption of all rubbers in non-tire products was approximately the same in 1960 as it was in 1959.

Product Developments

A survey of the trade journals indicates the progress of this industrial and mechanical goods segment of the rubber industry by the number of references to new and improved products. It is not possible to include all of them in this brief review, but the mention of a few will indicate the progressive trend.

In the field of industrial V-belts the manufacturers have taken advantage of the improved tenacity and cord strength of Fortisan 36, nylon, and Dacron textile fibers. Belts with improved flex resistance and service life made possible by the use of these higher-strength materials can be used in smaller sizes for a given horsepower rating.

The manufacturers of hose have been able to develop types suitable for use with jet fuels, highly aromatic fluids, and many chemicals at temperatures as high as 350° F. The use of hose inner liners made with the fluoroelastomers has been a contributing factor in this field. Butyl rubber has found increased use in automotive heater and coolant hose.

There has been considerable development activity in the field of oil seals and O-rings. The use of fluoroelastomers for higher temperature resistance for automotive, missile, and electronic applications was noted. Fluoroelastomer-coated fabrics having high resistance to aliphatic and aromatic hydrocarbons, ozone, and acids are finding use for diaphragms and for gasket material for aircraft and missiles.

There has been continued reference to the use of rubber-asphalt blends for road surfacing. The problem of expansion joints for concrete pavements has been the subject of continued study and development. Many flexible rubber-type expansion joints have also been publicized, including an expansion joint composed of a neoprene compound bonded to steel in a unique design. In connection with road building, the successful development and use of large rubber blocks to replace wood blocks for railroad crossings has been reported. These have the advantage of being quiet and resistant to wear and weathering which make them superior to wood on heavily traveled highways. Improved types of rubber traffic markets for streets were also developed during the past year.

In the building industry the use of glass wall construction continues to encourage improvements in the types of sealing materials required for this application. The American Standards Association (ASA) approved an American Standard Specification on July 27, 1960, for polysulfide-base sealing compounds for the building trade, which covers performance properties of these compounds for use in sealing, calking, or glazing applications in buildings. Vulcanized extruded channel gaskets for sealing the windows in the aluminum and steel channels are finding greater use. Both the sealing compounds and rubber channels must insure tight, waterproof joints after varied exposure to heat and cold, moisture and general weathering.

Several companies have continued the development of portable bulk storage and transportation tanks. These are made with heavy-gage nylon fabric rubberized with oil- and weather-resisting compounds. These tanks range in size from 100 gallons to 14,000 gallons and can be designed for storage and transportation of crude oil, diesel fuels, gasoline, water, liquid fertilizer, vegetable oil, and many other liquids. They are also being considered for underground storage of fuel oils and jet fuels. When empty, the portable transportation tanks can be rolled into small bundles and returned for refilling.

A product of similar construction is being used as inflatable rubber dams for reservoirs. Another application of this type of product is the air-inflatable dunnage bag to replace timber for stabilizing loads in freight cars.

The home appliance industry, in particular, washers and dryers, are increasing the use of rubber items both molded and extruded. The use of detergents and various bleaching chemicals requires the use of compounds made from chlorosulfonated polyethylene and the fluoroelastomers in addition to SBR and neoprene. Chemical and heat resistance are the important factors in these applications.

The most recent addition to the list of specialty polymers are the polyester and polyether rubbers generally referred to as a solid urethane rubber. Being tough and having excellent resistance to abrasion and oil, this type of rubber is finding application in industrial solid tired wheels and for seals and oil rings.

The new stereoregular polyisoprene and polybutadiene rubbers will undoubtedly find application in mechanical goods products.

Technical Committee Activity

The technical committees of The Rubber Manufacturers Association, Inc., the American Society for Testing Materials, and the Society of Automotive Engineers-ASTM Joint Technical Committee on Automotive Rubber started developments in 1960 and have them well under way which will be of great assistance to the manufacturers and users of industrial and mechanical rubber products. During the past year RMA technical committees have made much progress in the preparation of a "Handbook for the Packing Industry," a "Handbook for the Hose Industry," and an "AQL Handbook for Molded and Extruded Goods."

The SAE-ASTM Technical Committee on Automotive Rubber and ASTM Subcommittee XVI of Technical Committee D-11 are preparing a revised version of ASTM D-735 (SAE 10R), Methods of Classification of Elastomeric Compounds. When completed, it will replace the present D-735 as a means of specifying rubber compounds in terms of their physical properties for all segments of the rubber industry including automotive.

Latex Technology

By L. H. HOWLAND

Naugatuck Chemical Division,
United States Rubber Co., Naugatuck, Conn.

and J. U. MANN

United States Rubber Co.,
Research Center, Wayne, N. J.


Kal Weyner

L. H. Howland J. U. Mann

FIGURES released by the Department of Commerce relating to the consumption of latex in the United States during 1960 indicated increased usage of SBR and a decrease in the use of other elastomers, when compared to 1959 use. Total latex consumption was about 91% of 1959 use. The greatest decrease was in the use of natural rubber latex, to about 70% of the 1959 consumption. Some of the factors involved in this change were general business conditions and replacement of some latex foam by polyurethane foam in products utilizing these materials. Also, in the manufacture of latex foam a considerable amount of natural latex has been replaced by SBR latex, owing in part to the high cost of the former and to the appearance of higher quality, higher solids cold SBR latices, some of which have been made by various new agglomeration techniques.

Worldwide use of natural rubber latex is expected to follow the trend which was evident in this country. High solids SBR latex is now being exported from the United States and will be manufactured in Europe, permitting its substitution for larger percentages of natural rubber latex in the manufacture of foam.

Natural Latex

In the natural rubber industry, the use of plant hormones (2,4D) to stimulate the productivity of old trees attained widespread use during the past year. Application of such materials to the tapping panel is said to raise the yield of a rubber tree by 20 to 30%. Most latex producers are stimulating all prewar plantings. These trials are being watched carefully to determine whether any bad effects accompany the use of hormones over a long period of time.

Also of interest in the natural latex industry is the extensive program of replanting and new planting in Malaya. In this program, new high-yielding trees will be planted to improve the efficiency of plantation operation. Much of this effort is on small holdings, under government sponsorship, as well as on the large estates.

Synthetic Latices

While the total latex consumption in this country was declining, the use of SBR latices increased by about 10%, which was due largely to the increased use in foam of the new high solids cold SBR latices such as Naugatex 8174[1] and Pliolite 5352.[2] These latices contain smaller amounts of non-rubbers (emulsifiers, electrolytes, etc.) than the 2105-type latex; and they gel more sharply in the Dunlop foam process, permitting the use of higher percentages of SBR in foam. Industry figures indicate that the fraction of SBR in latex foam rose from about 50% in 1959 to about 65% in 1960.

Literature references to the use of silica, starchy materials, and resin latices to reinforce the modulus of latex foam appeared with frequency. The increased modulus of the polymer coupled with the improved froth fluidity of the new high solids SBR latices is expected to allow the production of lighter-weight foam

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[1] Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
[2] Goodyear Tire & Rubber Co., chemical division, Akron, O.

with normal load-carrying capacity. Here again the impact of the use of urethane foam is evident as manufacturers strive to reduce the cost of latex foam.

High solids nitrile latex is finding application in foam for lubricating pads. The superior resistance of this polymer to hot oil allows it to compete with the materials which have enjoyed this business in the past. While this is not a large outlet for nitrile latex, it represents a new application.

Work with aqueous dispersions (latices) of elastomeric polymers made by non-aqueous polymerization developed considerably during the past year. Latices of butyl rubber have been available for some time, and now the use of dispersion techniques has been expanded to include the stereospecific polymers of butadiene and isoprene as well as the ethylene-propylene rubbers. These new latices have been prepared experimentally with particle sizes in the range of natural latex. One method that has been reported for making latices from solid rubbers involves emulsifying a solution of the polymer in water and subsequently stripping off the solvent and concentrating the latex.

The trend in latices for carpet backing and some textile work has been away from those latices that require conventional vulcanization with sulfur and accelerators. In general, the new latices contain butadiene and styrene and in some cases a third monomer which may be any one of several which confer the desired properties on the polymer. In these applications the latex polymer must have good strength, flexibility, and resilience and must resist discoloration when aged under a variety of conditions.

The use of these new latices for certain textile applications leads to simplification of the latex compounding operation as well as to economies in processing, since no time is required for vulcanization. Latices related to these have also been used in paper treatment to give products improved over those made with previously available latices.

Also in the field of textile treatment, a new acrylic-type latex has become available. This polymer, with a catalyst, is said to be bonded firmly to the textile fibers so that in one operation the combined effects of treatments with thermosetting resins and with latex are obtained.

Water-base paints continue to be large-volume users of latex. Acrylate and vinyl acetate latices are being used on exterior wood surfaces. Many major paint manufacturers are involved in this development, on a large scale. It is predicted that this type of exterior paint will give better outdoor service than the oil paints that have been used for so many years. For interior paints, although styrene latices are still widely used, vinyl acetate latices are offering strong competition.

New applications of latex in industrial finishes are increasing. Several major automobile manufacturers are using butadiene-styrene latex primers successfully. A thermosetting acrylic latex is being used as primer and topcoat in appliance finishes with the possibility that it may be used also in automobile finishes.

Footwear

By B. H. CAPEN

Tyer Rubber Co., Andover, Mass.

B. H. Capen

CHANGES and developments in the rubber footwear industry have been numerous and, in many cases, quite radical for an industry that has for years made quite conservative merchandise. The most rapidly expanding and changing category of the industry is in the field of fabric-rubber soled footwear. The bulk of the fabric-rubber soled shoes of the past year has been, as before, made with canvas uppers, and these shoes will in the future represent a very large percentage of the shoes manufactured.

Fabric-Rubber Soled Shoes

New fabrics such as corduroy and brushed nylon are being introduced into the manufacture of fabric-rubber soled footwear, and one hears that brocades also will be of interest. With the large assortment of suitable fabrics available, do not be surprised at any new fabric-rubber soled shoe that may appear in the future.

Not only the new fabrics, but also the array of colors that are in vogue at present have been of interest. Were one to state some of the sought-after colors in fabric-rubber soled footwear, he would mention greens, golds, and plaids. It is unquestionably due to this availability of colors and new fabrics that some retail outlets state that they have had an increase in sales of 30% to 35% in the past year in fabric-rubber soled footwear.

Another change has been made which also contributes to this increase in sales, and that is the styling of the shoe, particularly as to the last. For many years a round toe was offered—this past year we saw the introduction of the tapered toe as well as the pointed toe. This last appeals to a new clientele. They are the young women and teenagers who want more than one style of rubber-soled shoe, and now they have style as

well as colors and fabrics to choose from. There has been some interest in the manufacture of rubber-soled casuals for middle-aged women who demand shoes with elasticized uppers so that they can slip in and out of the shoes easily.

Types of fabric-rubber soled shoes for men's wear include leisure-time casual and the sporting type, such as tennis, basketball, and boating shoes.

The casual shoes are made for the most part by the molded-on sole process, and they utilize many fabrics and colors. Some of these types of shoes have their closure made of elastic gore rather than lacings, which makes a very satisfactory shoe. As for the tennis shoes, little can be said about anything new, and they are made of conventional heavy-duty canvas fabric and rubber soled.

Basketball shoes are made today in large quantities by the molded-on sole process and have proved very satisfactory. There has been introduced into the market a basketball shoe that has the feature of a built-in ankle support. A basketball oxford is being offered which combines the basketball molded sole with an upper of oxford height.

Another style of fabric-rubber soled shoe that had excellent acceptance last year is the boat shoe. The main innovation of this shoe is the construction of non-slip features for use on wet surfaces. This sole is being offered in construction of lands, cleats, and by the actual insertion of a treated rope into the sole. With more people owning boats of various descriptions, the industry feels that there is a growing market for this type of shoe. For youngsters and tots there are boat shoes of the same construction, and there was some introduction of colors and new fabrics in this category also.

In the field of molded-on soles there is an excellent acceptance of the flat rubber-soled shoe, and it is a very strong competitor for the California-type of casual shoe business.

Waterproof Footwear

In the waterproof section of the footwear business there has not been as much introduction of new ideas and construction. The over-the-shoe type of merchandise has been made slightly lighter in weight, yet gives adequate protection. The greatest interest is in the field of heavy work goods and in the sporting goods field. As might be expected, there is a very active and attractive market for the insulated-type waterproof shoe for both hunting and fishing. For the water there is provided the usual anti-slip features of lands, cleats, and inserted rope soles.

The women's line shows very little change except for some specialty items which introduce fabrics as the upper. The accepted fabric for this use so far has been nylon. Women's waterproof shoes are being offered in a variety of styles and, in addition to style, give protection from snow, water, and cold weather. The difficulties arising from the necessity of making waterproof footwear to fit over the spike heel have been overcome to a great degree.

The plastic footwear line is offering some features that will help in its acceptance to the trade. This footwear is being styled in the modern trend and is being made with tapered toes. This plastic footwear fits well and has come a long way from the original footwear that was offered. To assist in putting on and taking off, plastic shoes are being flocked with cotton on the inside. Better compounds have made the shoe more acceptable to the public, particularly as to improvement of flexing in cold weather. Men's, boys', women's, and misses' styles are being offered with zipper closure—this has been a long step forward and has assisted greatly in dressing up the shoe with modern styling.

The advancements of the past year have been interesting and have been the means of presenting to the public better styled and more attractive footwear in all lines of waterproof, plastics, and the very popular fabric-rubber soled shoes.

Soles and Heels

By R. L. QUINLAN

Goodyear Tire & Rubber Co., Windsor, Vt.

R. L. Quinlan Smith

PRODUCTION of shoes, excluding rubber footwear, was estimated at approximately 610 million pairs for the year 1960. This is in relation to a production figure of 638 million pairs in 1959. The first six months of 1960 kept pace with 1959 in regard to shoe production, but the final six months showed a definite tailing-off. This production activity by shoe manufacturers has, of course, been reflected in the sole and heel industry. At this time, the best consensus of opinion among shoe people is that shoe production in 1961 will be about 640 million pair.

Rubber Soling Use Increases

In these last two years the percentage of soles used that are classified as "other-than-leather" soles has gone

up at the expense of leather. In 1957 the percentage of other-than-leather soles used was 66; in 1958 it was 67, and in 1959 it was 68. In nine months of 1960 the percentage was 71. This increase shows that the sole and heel industry has a larger share of the shoe bottom market than ever before.

This increase in the use of other-than-leather soles was caused by two main factors: (1) a substantial jump in the price of leather soling in the winter of 1958-1959 and (2) the development by the sole and heel industry of flexible quality nuclear soling with a soft, mellow, natural finish that could be processed in the shoe factory.

The last stronghold of leather soling was in the higher-price men's and women's dress shoes, and manufacturers of these shoes forced to maintain present price levels, in spite of increased labor and material costs, turned to flexible nuclear soling for cost relief. The price of leather soling softened to some degree in the past year, but there has been a further increase in the use of other-than-leather soling.

Another place where there has been some switch away from leather soling is in women's flats and platform shoes where the bottom material has been traditionally split leather. This split leather has a coarse, hairy appearance and is from the belly area of the hide. The sole and heel industry is supplying a cellular soling with coarse pore structure, which has an appearance very similar to this split leather.

Use of Plastics Increases

The year 1960 saw the further increase in the use of plastics in the shoe industry, and the sole and heel industry has been right in the middle of this development.

There has been a great acceptance of toplifting material made out of polyurethane for use on the "stiletto heels" now in fashion. Some of these heels use a toplift smaller than the end of a cigarette, and polyurethane toplifts with their long wear and very low spread characteristics fill a definite need.

Other plastic shoe components used in volume by the shoe industry are heel bases, counters and Dutchmen, usually made of polyethylene, and women's flattie heels made out of poly(vinyl chloride). There has also been a large use of plastics such as cellulose acetate butyrate and modified acrylics, in women's high heels, especially in the slim, stiletto type, owing to the need of more impact strength.

This last year saw the use, in volume, of soling material made from a poly(vinyl chloride) base. Vinyl bottoms with the heel and sole molded as one unit are now being used on boys' and youths' shoes. This soling is molded from a soft, flexible long-wearing poly(vinyl chloride) compound, which is attached to the shoe by means of heat-sealing the bottom unit to a vinyl welting which has been prestitched to the upper. These shoes are sold at a premium above the normal price, usually with a guarantee of wear on the sole and heel.

The excellent performance of this plastic soling has gone a long way to dispel the bad feeling in the shoe industry toward vinyl soling engendered by the unfortunate experience this industry had in World War II. At that time, vinyl was used as soling indiscriminately, without regard to flex safety and other quality standards, and there was widespread failure of such soles in service.

An automatic machine is now in the field-testing stage wherein vinyl soling is injected directly to a shoe upper in one operation. The upper leather is prece-mented, and this process seems to give excellent bond strengths of the vinyl soling to the upper. It is known that several large shoe companies now have some of these machines on an experimental basis in their plants. A large expansion in this method of making shoes would obviously not be good news for the rubber sole and heel industry. The machines and the molds used in this process are expensive, and immediate rapid expansion of the process, however, is not likely.

There is considerable development activity in the direction of a firm poly(vinyl chloride) soling that can be attached to the shoe by conventional methods for use on all basic-type shoes. This development is a corallary to the increasing acceptance of vinyl as a soling material by the shoe manufacturers.

Other Developments

The direct-molding of rubber-based soles and heels to the shoe upper in low-pressure vulcanizing machines is still in use, but the use of this process does not seem to be expanding at the rate it was several years ago. This method of making shoes has been largely confined to low-priced casual shoes with other-than-leather uppers, and work shoes. There is very little activity in the field of dress shoes made by this process, contrary to the trend abroad. Some say that the rapid style changes in the United States inhibit this method of making shoes because of its requirement for expensive metal lasts and molds.

There was still a large usage of soft, resilient microcellular soling in 1960 as shoe bottom material. The use of this type of soling has been at a level of approximately 15% of the amount of other-than-leather soles used in the U.S. and has stayed at that level for the last five years.

In the shoe repair field, the year 1960 saw the continuation of the trend away from the small, neighborhood one-man operation to larger shops with a number of employes, usually situated in large, retail centers. These larger shops specialize in fast service and can afford automatic heel nailing machines, usually of the Auto-Soler type. These nailing machines necessitate use of heels with a hard core rather than heels with washers.

Heel cores had traditionally been made of wood, but in the last two years the sole and heel industry introduced heels with cores of a hard, dense rubber-base material which have the necessary nail-holding power. These cores are superior to wood cores and have accelerated the trend away from washer heels to core heels.

The present situation in the sole and heel industry is

a highly competitive one, and it is likely to continue that way with the shoe manufacturer, unable to pass along increased costs to the consumer, maintaining pressure on the sole and heel industry for adequate, but lower-priced components. There is nothing static about the sole and heel industry, and through its very active research and development program it will continue to develop better wearing, more attractive, and less costly shoe bottom components to keep up with the demands of the shoe industry.

Insulated Wire and Cable

THE cable industry produces a tremendous variety of products from large high-voltage power cable to the hook-up wire used for miniaturized electronic equipment. There have been no major changes in the usage of materials, although trends which have been evident continued in 1960.

The usage of natural rubber in low-voltage wires and cords has been almost completely eliminated. At present, SBR, polyethylene, or poly(vinyl chloride) is used. At voltages of the order of 5 to 15 KV, the high ozone resistance of butyl rubber has led to its wide acceptance. Neoprene continues to be used where flexibility and flame resistance are important. During the year further progress was made in improving the low-temperature properties of jackets for military cables.

Polymer Developments

Improving existing synthetic polymers is a continuing effort at the polymer producer level, which is illustrated by the array of polyethylene types available on the market in 1960. This intensive development on the part of the polymer supplier has provided the wire and cable fabricator with so-called tailor-made polymers for specific end-uses and should result in even wider acceptance of polyethylene for both insulations and jackets.

Somewhat related to the development work carried on by the polymer producer is the research work by individual laboratories within the wire and cable field. A unique product of such research is the chemically cross-linked polyethylene, Vulkene,[3] developed by the General Electric research laboratory. This insulating composition, when cross-linked by chemical means, becomes a thermosetting material, thereby overcoming some of the weaknesses inherent in polyethylene. Thus, General Electric's new Vulkene industrial control cable combines electrical properties similar to those of polyethylene, but with thermal properties superior to those of most heat-resistant rubbers, either natural or synthetic. The cable is designed for use in air, conduit, underground ducts, or for direct burial.

Product Developments

In the power field the tendency toward higher distribution voltages continues. There has also been an increase in the use of underground distribution systems in residential areas.

Rome Cable research laboratories, in cooperation with the E. I. du Pont de Nemours elastomer chemicals department, developed a new chlorosulfonated-polyethylene (Hypalon)[3] insulated building wire product involving an extruded single-layer thermosetting covering serving the dual purpose of insulation and sheath. This new material possesses superior physical properties in addition to added resistance to chemicals and heat.

After an extensive fact-finding investigation the Underwriters' Laboratories extended an approval to this new product as both Types RHW (75° C. wet locations) and RHH (90° C. dry locations) building wire. This wire is available in a complete size range of aluminum and copper conductors and has been given the trade designation of "RoPalon."[3]

Non-metallic sheathed cable widely used in residential wiring has been improved by a new approved type introduced by Triangle Conduit & Cable Co., called Therma Triex.[3] This product has the familiar braid replaced with a flame oil-, acid-, and alkali-resistant poly(vinyl chloride) jacket.

Military cables with their requirements for maximum performance in the presence of difficult environments continue to challenge the ingenuity of the cable designer. These cables frequently combine power conductors with carefully matched or balanced control or communication wires. An example of this type is the power and control cable built by the William Brand-Rex division of American Enka Corp., for use on the Pershing Atlas, Titan, and Minute Man projects. In this cable, the individual conductors are insulated with extruded F.E.P. Teflon[3] and a Dacron[3] braid. An overall reinforced neoprene jacket is used.

The trend toward miniaturization continues, particularly for electronic equipment. New designs require smaller conductors and lower insulation wall thicknesses. In conductor size an extreme has been reached in the magnet wire used in the newly introduced electric wristwatches. The REA Magnet Wire Co. is producing wire with a conductor diameter not much more than one tenth the diameter of a hair.

[3] Trade marks.

The use of aluminum continues for applications where its high conductivity per pound and per dollar makes it attractive in spite of the larger diameter required. Kaiser Aluminum & Chemical Corp. has capitalized on the low weight of aluminum to make a mine sweep cable which requires much smaller floats than an equivalent copper cable.

Several interesting types of cable have been developed for submarine use. One produced at the Worcester, Mass., plant of the American Steel & Wire Co. is being used by the U. S. Bureau of Commercial Fisheries. This cable is designed to transmit information on the depth of the net, the water temperature, the ground speed, whether the net is on the bottom, and even the size of the catch.

Another cable made by this same company will make possible underwater exploration using a remotely controlled underwater vehicle. The vehicle will be highly instrumented and contain television cameras as well as facilities for collecting samples. A five-mile length of cable allows the device to operate over a wide area and at depths as great as 20,000 feet.

The cables used by the telephone industry for many years had lead jackets. In recent years there have been several changes, and the cables now being installed have polyethylene insulated conductors which are not affected by moisture. This development has made possible the latest change to a single corrugated aluminum shield with an overall jacket of weather-resistant polyethylene. This construction is known as Alpeth-PIC.

Whitney Blake Co. has introduced a new jacketed pair distribution wire for telephones called the "Ready Access Cable." This features a polyethylene-insulated high-strength messenger around which are placed a number of pairs. Each pair consists of two polyethylene insulated conductors twisted and jacketed with poly(vinyl chloride).

Manufacturing Developments

The telephone industry makes and uses a tremendous amount of insulated wire each year. As a result, the highest degree of mechanization can often be justified. Western Electric Co. described in the October, 1960, issue of its publication, *The Engineer*, a highly developed installation in its Baltimore, Md., plant. This equipment automatically supplies continuously blended poly(vinyl chloride) compound to a large battery of tubers.

In another development Western Electric has been able to combine two tubers in such a way that two different materials can be extruded simultaneously. This process is normally used to produce a wire insulated with polyethylene and jacketed with PVC.

Ferenz Fedor

J. M. Ball

Reclaimed Rubber

By J. M. BALL

Education Committee,
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THE consumption of reclaimed rubber in the United States for 1960 is expected to be close to 290,000 long tons, the same as for 1959, which was the biggest rubber consuming year since 1955. This 1960 figure represents a consumption ratio of reclaimed rubber to total new rubber of approximately 18%.

This steadiness in position reflects the inherent essentiality of the rubber reclaiming industry, especially in view of the fact that in November, 1959, there was a price rise of approximately 5% necessitated by increased labor cost which represents about 30% of the total cost of producing reclaimed rubber.

New methods and new equipment are constantly being introduced for the purpose of improving quality and for offsetting the upward push on labor cost. For example, in one plant continuous filler blending systems have been installed to team with what is already a continuous reclaimed rubber production process.

Around-the-clock quality control has been tightened on the raw material and the finished product. Frequent periodic determinations are made on viscosity, specific gravity, and cleanliness.

Slabs of reclaim are now generally cooled throughout before they are stacked and stored, thus greatly improving storage stability in the manufacturer's and the customer's warehouse.

Baled Reclaimed Rubber

One of the important developments has been the introduction of reclaimed rubber in bale form. The thin sheets from a line of refiners are individually blown up into a tower where they become blended in mid-air, are weighed automatically, then released into the baler. Among the advantages of reclaimed rubber in bales are these:

1. The draft of air removes the heat from each of the thin sheets produced by the individual refiners,

thus insuring maximum storage stability of the finished bale.

2. The uniformity throughout the bale with respect to viscosity and cleanliness is at a maximum because the output from a whole line of refiners is blended.

3. Shipping and storage economies are possible because more pounds can be put on a pallet so that fewer pallets are required to meet minimum loads, and less storage space is needed.

4. Bales are of guaranteed weight, so that weighing is expedited. Furthermore, this guaranteed weight can be adjusted if necessary to conform to a customer's batch requirements.

Non-Staining Grades

Many reclaimers have developed new stocks and have improved their standard stocks. The use of non-staining reclaims has expanded.

Another important development has been a new patented process for the production of improved non-staining reclaims by the action of formaldehyde during or immediately following the cooking or digestion operation. After such treatment the resulting dried stock is compounded in the usual manner with additional non-staining plasticizer and active carbon. The formaldehydye forms in situ non-staining reaction products of normally staining accelerator and antioxidant ingredients of the reclaim. An additional advantage is improved cleanliness and reduced tailings.

Other Developments

One reclaimer, in the interest of diversification, has installed a custom mixing division, the activities of which include the production and sale of cross-linkable polyethylene compounds in dice form.

Confidence in the future of the industry is reflected by the recent complete rehabilitation of one of the older reclaiming plants, creation of new warehouse space in another plant, and construction of an entirely new and modern plant in still a third location. Furthermore, one reclaimer has been successful in licensing companies in certain foreign countries to use a reclaiming machine which this reclaimer had developed in past years.

In conclusion, the rubber reclaiming industry in the United States is now in excellent condition and is expected to continue to flourish with the anticipated normal expansion of the entire rubber industry.

S. D. Gehman

The Physics of Rubber

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IT WILL be possible here to touch on only a few of the many current, interesting, and significant developments and applications of physics to elastomers. The selection of topics is to be regarded as illustrative of a few rather advanced activities in the field of elastomer physics, but by no means as giving a comprehensive picture of the many worthwhile accomplishments and advances which are occurring all along the line in the contributions from physics to the development of elastomers and their products.

Space Technology

Elastomers will be going out into space in various connections[1] with the new space technology where they will be expected to perform similar functions as on earth. The extreme environmental conditions of heat and cold, solar and cosmic radiation, micrometeoric erosion, all in a vacuum, pose many puzzles in trying to anticipate how elastomers will perform under such circumstances.

The physical problems involved in these out-of-this-world applications make it very difficult to choose properties and materials on the basis of the physical evaluations and experiences of the past. The need of more pertinent test data is fostering physical test procedures for these purposes which are carried out under conditions which correspond more closely to space environments so that the results can be more useful in meeting space requirements. It is reasonable to expect that there will be a "feedback" of improved physical evaluation procedures and materials for extreme earthly uses also.

EPR Spectroscopy

Methods which had deep origins in basic research and experimentation in molecular physics, such as infrared and mass spectroscopy, are now almost commonplace and widely used in the research and development segments of the rubber industry. They are well established and continue to show a broad pattern of growth for

[1] *Missile Design & Development,* 6, 7, 6 (1960); 6, 9, 60 1960); *Aviation Week,* 73, 15, 31 (1960); T. L. Smith, *Ind. Eng. Chem.,* 52, 776 (1960).

identification, analytical, and control purposes and have become well nigh indispensable in the development of new elastomers. A long line of evaluation from the original physics research and experimentation preceded such uses for the methods since they are characterized by complex, precise, and relatively expensive instrumentation. There are two newer, somewhat analogous situations from physics research which have been developing from Nobel prize winning discoveries which occurred about 15 years ago, nuclear magnetic resonance spectroscopy (NMR), and electron para-magnetic resonance spectroscopy (EPR). Exploratory investigations using these methods are evidently beginning to yield results of rather broad interest for rubber research and elastomer developments. NMR is the older of the two as far as rubber research is concerned so that here it will be appropriate to emphasize the more recent work with EPR.[5]

Both methods are based on the magnetic properties of immutably spinning electrically charged entities, atomic nuclei in the case of NMR and electrons in the case of EPR. The instrumentation provides the capability of extracting signals from the spinning particles, that is, of securing records which give information about the chemical and physical structure through the magnetic interactions of the spinning electrons with externally imposed magnetic fields and with local fields arising from neighboring spinning particles. The exotic nature of the technique may be indicated by the fact that the attainment of resonance using a reasonable value for the external magnetic field requires the use of microwave or radar frequencies, usually about 10,000 million cycles per second.

For ordinary electrons in organic compounds, the spins are "paired," that is, occur in opposite directions for various electrons so that there is no resultant electronic magnetic moment, and no EPR signals can be obtained. The importance of EPR for rubber research lies in the fact that free radicals, the short-lived, fragmentary intermediates in most vulcanizing, aging, milling, reinforcing, and polymerization reactions, contain "odd" or "unpaired" electrons which do respond to EPR techniques. On this account, EPR has unique capabilities for furnishing information in regard to the quantity, structure, life-time etc. of the free radicals involved in so many of the most important phases of rubber chemistry and technology and hence possibilities for disclosing and establishing reaction mechanisms which are now largely speculative. When these reactions can finally be unraveled and understood in good detail, it will mark a new scientific era for rubber technology. If this can come about through a physical method such as EPR, it will indeed be another triumph for pure, uncommitted research.

Dynamic Properties

The study and explanation of the behavior of elastomers under vibratory or transient forces has been for many years an important area of the physics of elastomers and has a continuous interest and development. The ultimate goal is to be able to describe these properties over a complete range of temperature, frequency, and amplitude or rate of deformation and to account for them in terms of the molecular structure.

Several interesting new experimental approaches to these problems have appeared in recent work, which differ rather widely from the more usual procedure of applying a sinusoidal vibration to a test specimen and observing the response.[6] One of these new methods makes use of principles and mathematics which were developed largely in connection with the study of transients in electrical systems. It is instructive to see these techniques applied to rubber. The experimental work involves the measurement of the response of a system to an impulse or "step-function," i.e., a force which rises "instantaneously" at zero time to a constant value. In theory, if the response to a unit step function is known, the response to any force can be calculated. The method involved the application of a sudden "instantaneous" force to a rubber-mass system and the observation of the deformation with a cathode-ray oscilloscope. From this response, the response to any other applied force can be deduced within the limits of accuracy, of course, with which a true step-function can be realized experimentally and with which the response can be measured.

A somewhat related experimental procedure is to stretch the rubber at a very high rate of speed to a fixed elongation and to observe the rate of stress relaxation with a high-speed recording system. The ultimate advantage of these newer procedures over the more usual methods of forced or resonant vibration remains to be established, but they have certainly opened up new possibilities and approaches for adding to our understanding of the dynamic properties of elastomers.

In conclusion, it may be of interest to note at least one very practical result of physics research in the area of dynamic properties on an international scale.[7] Dynamic test procedures were developed in Germany about three years ago to provide an instrument which would follow the progress of the cure of a rubber specimen continuously and thus eliminate the need of molding a step-wise series of rubber test sheets to determine the curing characteristics of a compound. The work has been taken up in England and the United States, and two commercial variants of the instrument are now available.[8] The technique appears to have broad uses for determining in an unusually convenient and elegant way curing characteristics such as state of cure, optimum cure time, delayed action, scorch time, and reverting tendencies as well as having possibilities of being adapted by production laboratories for some factory processing control purposes.

[5] G. Kraus and R. L. Collins, RUBBER WORLD, 139, 219 (1958); D. Libby, M. G. Ormerod, A. Charlesby, *Polymer*, 1, 212 (1960); S. E. Bressler and coworkers, *Rubber Chem. & Tech.*, 33, 462; 469 (1960).

[6] M. Berger, *Proc. Intern. Rubber Conf.*, Washington, 1959, p. 375; R. M. Cardillo and W. W. Gleason, RUBBER WORLD, 142, 95 (1960), (abstract only).

[7] J. Peter and W. K. Heidemann, *Rubber Chem. & Tech.*, 31, 105 (1958); A. R. More, S. H. Morrell, A. R. Payne, *Rubber J. & Intern. Plastics*, 136, 858 (1959); W. E. Claxton, F. S. Conant, J. W. Liska, RUBBER WORLD, 142, 4, 90 (1960), (abstract only).

[8] The Vulkameter, Agfa Physik, Munchen, Germany; the Wallace-Shawbury Curometer, Testing Machines, Inc., Mineola, N. Y.

Testing Five Grams of Rubber[1]

Special techniques have been devised to answer the problem—how to test physical properties of a polymer when only small samples are available

By G. J. BRIGGS, W. H. EMBREE, E. G. KENT, and W. H. WATSON
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THE work in the early stages of the development of many new types of synthetic rubbers produces only relatively small amounts of polymer. For example, polymerization carried out in a six-ounce bottle provides only about 35 grams of dry rubber. Polymerization in the next largest size container will increase this amount to only about 300 grams. In order to do the required compounding development work, it is necessary that several batches of compound be prepared from these small samples of rubber polymers. There is the need, therefore, of equipment and techniques for the compounding, mixing, and testing of very small samples of rubber, particularly in laboratories where many small-scale synthetic rubber polymerizations are run.

As a first step in designing equipment for micro-scale compounding and testing, a search of the rubber literature was made to determine what was already available. Of the references[2-4] found, the most complete description was that by Garvey.[2] None of these designs, however, completely satisfied the requirements of Polymer Corp.

It was not felt that the degree of precision obtained in conventional laboratory compounding and testing would be necessary or attainable with micro techniques. The primary aim was to obtain results from which trends could be noted as changes in polymerization conditions were made. As will be shown later, the test data secured using micro-scale compound and testing equipment were, however, remarkably reliable.

Design and Operation of Micro-Scale Equipment

After a number of experiments, a small two-roll mill and sample molds were designed and built. The mill shown in Figure 1 has two rolls, each one inch in diameter and 3½-inches long. Guides are placed at each end of the rolls to reduce the working length to two inches. Both smooth and corrugated surfaced rolls were made. A wide range of roll speeds was made available by having the rolls driven individually through variable-speed Graham transmissions by ½-horsepower electric motors. Each motor can be turned on or off separately, and the speed of the rolls can be varied independently from 0 to 62½ rpm. The distance between the rolls can be varied from 0 to 0.065-inch.

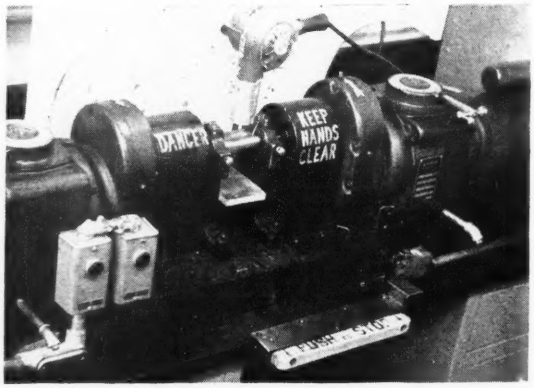

Fig. 1. Polymer Corp., Ltd., micro mill with individual drive for each roll. Device over rolls is for heating or cooling rolls or stock with air

Mill Operating Procedures

During the development of an operating procedure for the micro-scale mill, the principal criterion was that the operator be able to follow closely established mixing instructions and obtain a compound as similar as possible to that which would be obtained by macro procedures. Variations in speed and separation of the rolls were made until it was possible, using this micro-scale equipment, to get the same degree of rubber breakdown in the same time as was obtained on a 6- x 12-inch mill, using the standard mixing procedure. After this condition was determined, operating procedures on the micro-mill were written for all conventional-type rubbers.

It has been found that for normal-type rubbers there is no difference in the physical properties obtained when either the smooth or the corrugated micro-scale rolls are used. Certain difficult-to-mix polymers gave good results when mixed on the corrugated rolls, but poor results on the smooth rolls, relative to what could be obtained on standard-size laboratory equipment. Because of this situation, it is customary to use the corrugated rolls for most mixing operations.

It would be difficult to heat and cool the small-size micro-mill rolls by steam and water, as is done with

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[1] Presented before the Division of Rubber Chemistry, CIC, Kitchener, Ont., Canada, Apr. 8, 1960.
[2] B. S. Garvey, Jr., *Rubber Chem. & Tech.*, 16, 679 (1943).
[3] A. E. Juve and C. H. Schroeder, India RUBBER WORLD, 115, 515 (1947).
[4] S. D. Gehman and R. P. Clifford, *Rubber Chem. & Tech.*, 27, 1, 503 (1954).

W. H. Watson — E. G. Kent — W. H. Embree — G. J. Briggs

The Authors

G. J. Briggs, research physicist, is an engineering physics graduate of University of Toronto (1951). He has been working on problems of mechanical properties and evaluation methods of polymers for Polymer Corp. since graduation.

W. H. Embree, senior research chemist, has M.A. and B.A. degrees from University of British Columbia. He joined Polymer in 1949 and has been in research and development compounding department for past five years.

E. G. Kent, in charge of micro compounding, has been with the research and development division since 1945. He helped set up the micro compounding section in 1955 and has been in charge since 1958.

W. H. Watson, chief compounder, is a chemical engineering graduate of University of Toronto (1942). He joined the research and development division when it was founded. Previously he was technical superintendent of the copolymer plant and before that was employed by Goodyear Tire & Rubber Co. of Canada, Ltd.

conventional mills. Consideration was given to heating the rolls electrically, but this procedure was not felt to be necessary. One means of heating the rolls is by suspending an infrared lamp over the rolls and adjusting the distance between the lamp and the rolls to control the temperature. By this means it is possible to raise the temperature of the stock to 250-300° F., depending upon the type of polymer.

An alternative means of temperature control is to blow heated or room-temperature air on to the mill rolls by use of the device shown in Figure 1. By this means it is possible to heat stocks to 300° F., or keep them cooled to 100° F. This type of operation is limited, however, to those times when pigments are not being incorporated into the rubber.

The greatest use of this micro-scale equipment occurs in the testing of new-type polymers whose properties often differ from those of conventional types. In such cases it is impossible to follow the standard mixing procedure used with conventional polymers. While experience is being gained, the compounder, in consultation with his supervisor, modifies the mixing technique for new-type polymers at his discretion. This type of development work requires a compounding technician with experience and ingenuity.

After a satisfactory micro-scale compounding procedure is established for a new-type polymer, the transfer of the operation to conventional-size laboratory mills usually can be predicted accurately, thus avoiding the larger rubber consumption that would be required in developing the mixing procedure on standard equipment.

Mill Safety Features

There is some difference of opinion as to whether a micro-mill is as hazardous to operate as is a macro-mill. In line with the safety policy at Polymer Corp., all practical safety features have been built into the micro-mill. A press bar on the mill bench face, which can easily be touched by the operator's body, activates a microswitch, cutting the power to the rolls. Because of the very small nip and the small amounts of materials being compounded, it is not practical to install the type of cradle safety trip normally used on macro-mills.

The base of the mill consists of a ¾-inch thick steel plate, split in the center. This plate can be moved by a hand-crank permanently installed on the end of the mill assembly. The hand-crank moves a worm gear, which in turn forces the mill base plate apart. The free ends of the mill rolls are pulled from their bearings, and when they are clear, the whole assembly can be swung apart. The object of this arrangement is to free quickly an operator, should he become caught in the mill rolls. During practice drill the operation has been carried out in seven seconds. Fortunately it has never had to be used in an emergency.

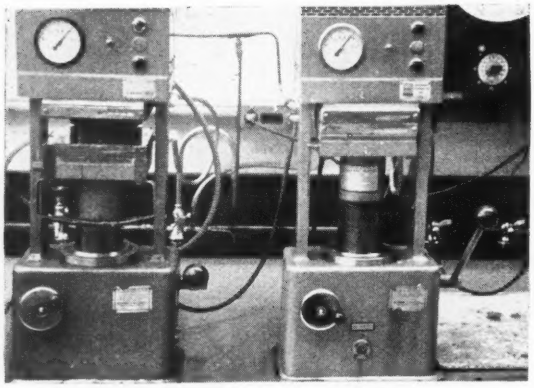

Fig. 2. Small electrically heated platen presses used for curing slabs for micro test specimens

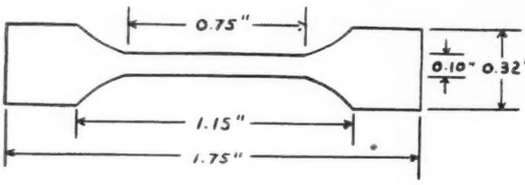

Fig. 3. Dimensions of micro-dumbbells

It is standard practice at Polymer Corp. that no one operates a rubber mill unless there is another person present. We feel that we have made the micro-scale mill as safe as possible: however, we limit its use to a small number of operators. The power to the mill is supplied through an electrical lockout, the key of which is in the possession of the qualified operators.

Curing Presses

Compounds prepared on the micro-mill are cured in the hydraulic presses,[5] shown in Figure 2, which have a range of platen temperatures from 0-600° F. A temperature is chosen that will give a convenient curing time, usually between 275 and 307° F. for conventional rubbers, higher sometimes for new polymers. For most polymers there does not appear to be any great degree of influence on the physical properties of the vulcanizate as the curing temperature is varied, but high-temperature curing must be avoided with certain polymers which are subject to reversion.

Preparation of Test Specimens

We have seen how small samples of rubber are compounded and cured by the micro-method. Now let us review the procedures used for physical testing.

Two means are presented for obtaining stress-strain tests on vulcanized samples. One is the use of micro-dumbbell specimens. These are obtained by curing sheets 2½ inches x 1½ inches x 0.03-inch thick and dieing out the test dumbbells, the dimensions of which are shown in Figure 3. The other test specimen is a ring sample, the use of which makes it possible to secure an autographic record of the stress-strain results. These rings are 1.35 inches in outside diameter and 0.10 inch wide and are similar except for size to the rings that are used on the Schopper tensile testing equipment. By use of the rings, it is also possible to measure hysteresis characteristics by alternately stretching the samples and releasing the strain.

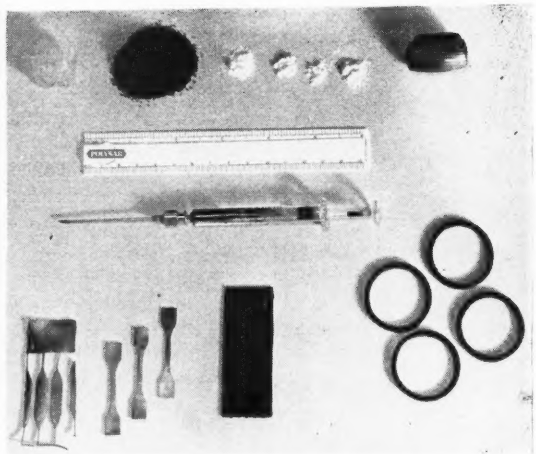

Fig. 4. Amount of rubber and dry compounding ingredients used in micro compounding *(top)*. Micro-rings, slab from which micro-dumbbells are cut, micro-dumbbells, remaining slab stock *(bottom, right to left)*. Hypodermic syringe for measuring liquid compounding ingredients *(center)*

It is the practice at Polymer Corp. to test these specimens on an Instron tester,[6] which has a high sensitivity over its entire range and on which very low modulus values can be measured. Owing to the considerable degree of variation possible in the rate of extension of the sample under test with the Instron machine, a wide variety of stress-strain curves can be obtained. Both ring and dumbbell specimens can also be tested on a Scott micro tensile testing apparatus.[7]

If stress-strain rings were to be died out of a test sheet, there would be a considerable wastage of rubber compound. Because of this fact, equipment was designed so that a ring could be transfer molded, using only sufficient material to form the ring.

For micro-scale work the amounts of compounding ingredients used for a mix and the resulting compounds and test pieces are shown in Figure 4. A six-inch rule is included to give a better idea of actual sample sizes. Liquid ingredients are measured by means of a hypodermic syringe; the other ingredients are weighed on an analytical balance. The weight of compounded stock is about eight grams, which is enough for 10 micro-rings or 32 micro-dumbbells.

Macro vs. Micro Techniques; Test Results Compared

Several factors involved in macro *versus* micro compounding, mixing, and testing were investigated. Com-

[5]Pasadena Hydraulics, Inc., El Monte, Calif., Model P-215.
[6]Instron Engineering Corp., Canton 71, Mass.
[7]Scott Testers, Inc., Providence 1, R. I.

Table 1. Comparison of Tensile and Elongation at Break From Macro and Micro Mixed Compounds

	Macro-Compound Micro-Dumbbells	Micro-Compound Micro-Dumbbells
No. of specimens	20	10
Tensile, psi.	2177	2242
Elongation, %	597	624

pounds mixed by the macro and micro methods were tested for tensile strength and elongation at break, using micro-dumbbell specimens in both cases. In another experiment a macro-mixed SBR gumstock was used to investigate the effect of the thickness of micro-dumbbells on tensile and elongation at break values. Finally, carbon black-reinforced compounds were made from various SBR types, butyl, nitrile, and *cis*-polyisoprene rubbers and mixed by the macro method for obtaining a comparison of tensile strength and elongation values as break for macro- *versus* micro-dumbbell specimens and macro-dumbbell *versus* micro-ring specimens.

Macro vs. Micro Mixing

For the comparison of macro *versus* micro compounding and mixing, a compound weighing 445 grams was mixed on a 6- x 12-inch mill, using the ASTM[8] procedure. Sheets were cured for 35 minutes at 293° F. in a standard ASTM mold, modified to give a sample thickness of 0.03-inch, the thickness required for the micro-dumbbells used. Using the same base polymer, the same compound in eight-gram batches was mixed on the micro-mill and cured in the micro-mold in the hydraulic press mentioned previously.

Micro-dumbbells were cut from the cured slabs mixed by the macro and the micro method and tested for stress-strain properties. The data are presented in Table 1 and show that there is no significant difference in the values obtained with micro-dumbbells from the macro-mixed ASTM batch when compared with those from the batches mixed by the micro technique. These data strongly suggest that there is little difference to be expected in the stress-strain values which were obtained from batches which were mixed by the macro or the micro method, when tested with micro-dumbbell specimens.

This same compound was shown to have lower values for tensile strength and elongation at break when standard-size dumbbell instead of micro specimens were used. This result is considered to be a physical phenomenon related to the thickness of the test specimens rather than mixing and curing techniques; that is, the thinner the test specimens the higher the tensile and elongation at break values obtained. It is generally assumed that the probability of a flaw is less with the smaller test piece.

[8] American Society for testing Materials, Philadelphia 3, Pa.
[9] *Rubber Chem. & Tech.*, 22, 4, 1125 (1949).

Effect of Specimen Thickness

In order to show the effect of specimen thickness on tensile and elongation at break values, an SBR gumstock was compounded, mixed, and cured by the macro method. Micro-dumbbell specimens of the same length and width, but varying in thickness from 0.02- to 0.10-inch were prepared. The data given in Figure 5 show that there is a regular decrease in tensile strength and elongation at break values with increases in the thickness of the test specimens.

Those values at the bottom of the curve in Figure 5 identified by solid circles were obtained below the breaking point of the specimens and represent modulus values common to specimens of all thicknesses. The lowest value identified by an open circle is the tensile strength and elongation at break for the 0.102-inch thick specimen, the next open circle gives the values for tensile and elongation at break for a 0.086-inch thick specimen, and so on until the values for a 0.02-inch specimen are given. The fact that the stress-strain values below the breaking points of the specimens of varying thicknesses are identical indicates that modulus values are independent of specimen size.

We have not looked closely at the effect of varying specimen width, but work by Higuchi, Leeper, and Davis[9] indicates that specimen volume is the controlling factor in determining the magnitude of tensile and elongation values at break.

Macro-Micro Specimens; Test Value Relation

The relation between values for tensile strength and elongation at break obtained with macro- and micro-dumbbells and with macro-dumbbells and micro-rings was determined using carbon black-reinforced compounds made from various SBR types, butyl, nitrile, and *cis*-polyisoprene rubbers. All the compounds were mixed by the macro method, and the test specimens prepared by the macro or micro method, as required.

Figure 6 shows the relation between the values obtained with the various types of specimens for tensile

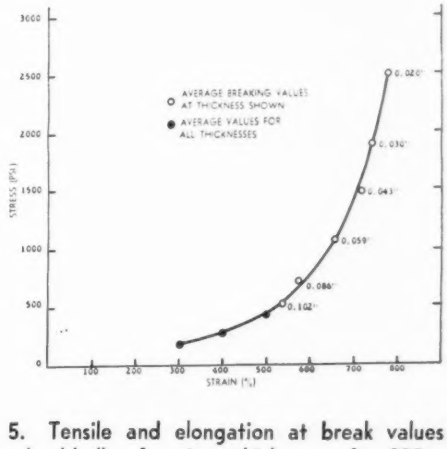

Fig. 5. Tensile and elongation at break values for micro-dumbbells of various thicknesses for SBR gumstock (open circles). Modulus values below breaking point for all thicknesses (solid circles)

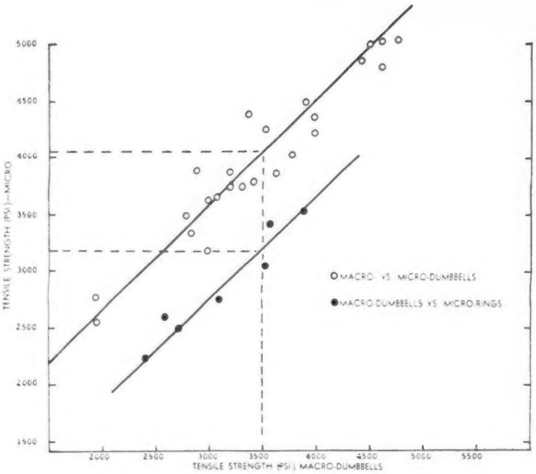

Fig. 6. Relations between tensile strength at break values obtained with macro- vs. micro-dumbbells and macro-dumbbells vs. micro-rings for carbon black-reinforced stocks of several synthetic rubbers

strength at break. The abscissa gives values from the macro-type test specimens up to 5,000 psi., and the ordinate gives values from the micro-type test specimens on the same scale for the vulcanizates from the several compounds tested. The lower line (solid circles) gives the relation between values obtained with macro-dumbbell specimens and micro-rings; the upper line (open circles) gives the relation between values obtained with macro- and micro-dumbbell specimens. Note that the line drawn vertically from a macro-dumbbell tensile strength value of 3,500 psi. intersects the micro-ring line at about 3,200 psi. and the micro-dumbbell line at 4,100 psi.

The similar relation for elongation at break values obtained with the macro- and micro-type test specimens for the same series of compounds is shown in Figure 7. Note in this instance that the line drawn from the macro elongation at break value of 600% intersects the micro ring line at 560% and the micro-dumbbell line at 630%.

Although these relations for tensile and elongation at break values obtained with macro- and micro-type test specimens for the range of rubber investigated seem well established, it is possible that they would be modified somewhat for other polymers where the behavior might not be entirely rubber-like.

Tensile and elongation values for ring specimens are lower than for dumbbell specimens of the same stock since the inner surface of the ring reaches the breaking elongation while the average elongation of the ring as a whole is still below the breaking point. The modulus values for a ring specimen (calculated from the extension of the median diameter) is the same as modulus values for dumbbell specimens.

The reproducibility of the test results for the macro-dumbbell and the micro-dumbbell and micro-ring specimens for the carbon black-reinforced SBR 1500 type compound is given in Table 2. Similar data can be produced for the other types of rubber.

As might be expected, the standard deviation is somewhat poorer for the results obtained with the micro specimens, owing to the fact that it is much more difficult to apply as rigid controls to the micro compounding, mixing, and curing procedures. Where a greater degree of reproducibility is required, it must be achieved by replicate testing.

Micro Testing—A Case History

An example of the type of work that can be done by micro compounding and testing is afforded by a brief description of the solution of a recent problem.

After considerable effort, about 225 grams of a special polymer had been prepared in our polymerization laboratories. We wished to make test samples from a 200-gram compound, and the curing characteristics of the polymer were not known.

Using a designed experiment, micro-compounds were prepared at five different accelerator-sulfur combinations, and three cures made at each accelerator-sulfur level. Hardness and stress-strain tests were made on all cures, and all of this work was done with 25 grams of rubber, leaving 200 grams for the macro-cure. From these data it was possible to predict the curing conditions required so that all the additional test data were obtained satisfactorily, even though there was only enough polymer for mixing a single macro-compound.

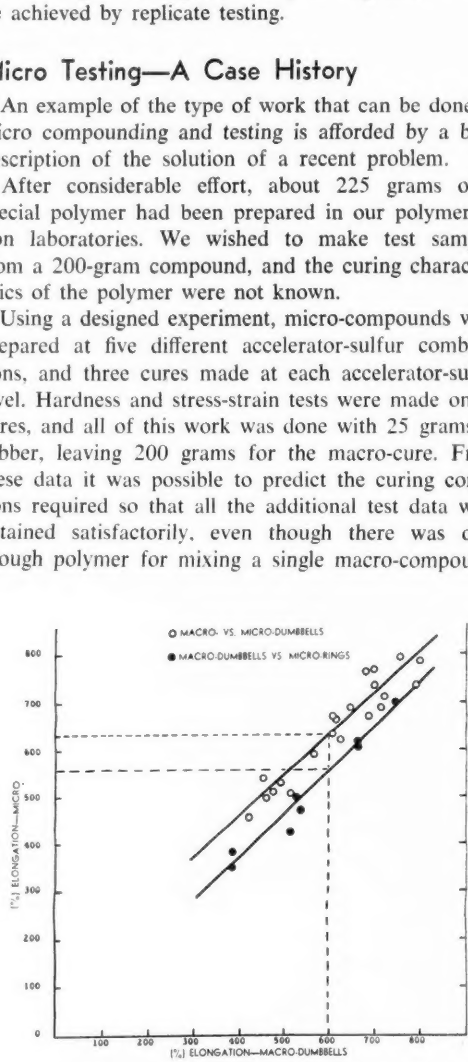

Fig. 7. Relations between elongation at break values obtained with macro- vs. micro-dumbbells and macro-dumbbells vs. micro-rings for carbon black-reinforced stocks of several synthetic rubbers

TABLE 2. STANDARD DEVIATION OF TEST RESULTS, SBR-1500 TYPE-CARBON BLACK REINFORCED COMPOUND

	ASTM Dumbbell Specimen	Micro-Ring	Micro-Dumbbell
Tensile at break, psi.	150	200	325
Elongation at break, %	20	35	40
300% modulus, psi.	45	80	55

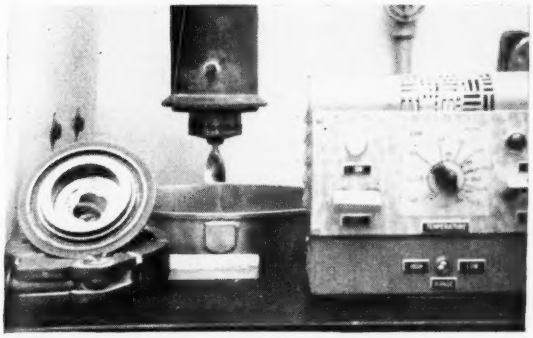

Fig. 8. Single-rotor micro internal mixer. Mixing chamber on left; main shaft with rotor at bottom in center, with container for temperature controlling liquid directly underneath; apparatus for controlling temperature of heating or cooling liquid on right

Special Micro Tests

Other types of tests have been developed on a micro-scale in addition to those for stress-strain.

It is possible to determine Mooney viscosity with only two grams of polymer, after making the necessary modifications to the Mooney viscometer, and the sample can be used again for compounding. In addition, a relation has been established between the Mooney viscosity run by the micro method and the viscosity obtained when the test is run under standard conditions.

In general, this micro Mooney viscosity test is not performed very frequently, however, because the molecular weight characteristics of a given polymer can be determined more reliably by an intrinsic viscosity technique, which usually gives more useful information than can be obtained from the micro Mooney viscosity test.

Rubber breakdown time on the mill, time required for mixing, tackiness, and behavior of a rubber on the mill at various temperatures can all be observed by the use of micro techniques.

Proper micro test pieces can be prepared also to measure hardness, low-temperature stiffening, torsional hysteresis, swelling in solvents and oils, Goodrich flex hysteresis, tensile set, etc.

Our experience in micro compounding, mixing, and testing is based on the successful evaluation of more than 3600 compounds over a five-year period.

Micro Internal Mixer

We have been studying a single-rotor internal mixer which could provide the means for making the equivalent of the mixing obtained in the Banbury or similar type of internal mixer with only two grams of rubber. This single-rotor mixer was designed by the British Rubber Producers Research Association[10] and is made by Baker Perkins Ltd.

Figure 8 shows the various parts of the single-rotor mixer. The mixing chamber is on the left; the main shaft with the rotor at the bottom is in the center; and the metal container used to contain the temperature control liquid is beneath the shaft. After the rubber and the compounding ingredients are placed into the mixing chamber, it is clamped to the bottom of the shaft; the container with the temperature control liquid is raised so that it surrounds the mixing chamber, and the mixer is ready to operate. On the right (Figure 8) is the apparatus for controlling the liquid temperature.

One of the features of this micro mixer is the range of temperatures that may be used which are greater than those available with any other such equipment of any size at present available. For example, a complete mixing operation has been carried out with the temperature of the compound held below 0° F. during the entire cycle. It is also possible to carry out mixing operations at temperatures as high as the equipment or the polymer can stand.

We have not completed a thorough study and comparison of the results obtained with compounds mixed in the single-rotor mixer and in conventional mixing equipment. There do not appear to be any problems in getting good mixing; so there is no reason to expect that the results with this mixer will not be so good as those found for compounds mixed on the micro mill.

Summary and Conclusions

By means of a specially designed two-roll mill, the use of small hydraulic presses with electrically heated platens, and special molds for the vulcanization of micro test specimens, the compounding, mixing, and testing of five-gram samples of rubber have been accomplished satisfactorily.

It has been established that there is no significant difference in the tensile strength and elongation at break values obtained with compounds mixed by the conventional macro or the micro techniques, when micro-dumbbell test specimens are used. It has been shown that the magnitude of the tensile and elongation at break values obtained with micro-dumbbells depends on the thickness of the test specimens within the range of thicknesses investigated. The relation between these same tensile and elongation at break values, when obtained using conventional macro-dumbbell specimens in comparison with micro-dumbbell and micro-ring specimens also has been determined. Data have been given to show the reliability of the micro test procedures compared to those obtained by macro methods.

It is possible to determine a number of other physical properties important to the production and use of synthetic rubbers by micro techniques in which the amount of sample required may be as little as two grams.

These techniques are particularly valuable to laboratories where many small-scale bottle-type polymerizations are run since these make possible the screening out of unsatisfactory rubbers at this stage. At the same time, if larger-scale pilot-plant polymerizations of promising polymers are run subsequently, most of the necessary information on the compounding and mixing conditions for the further evaluation and use of the larger amounts of these new synthetic rubbers has already been established, by the micro techniques.

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10 W. F. Watson and D. Wilson, *Rubber & Plastic Age*, 28, 982 (1957).

FASTER CURES

Without Loss of Processing Safety

An extra tire per mold per shift—NR/SBR blends with safe cures without retarder—direct molded footwear stock which may be shipped by regular truck rather than by refrigerated truck as before—tread rubber (camelback) with faster curing times, but with the storage stability and processing safety of regular tread rubber.

THESE above are some examples of how chemical (accelerator) loaded Molecular Sieves produced fast-curing stocks without sacrificing processing safety.

Molecular Sieves are synthetic crystalline metal alumino-silicates belonging to a class of minerals known as zeolites. An important characteristic of these materials is their ability to undergo dehydration with little or no change in their crystal structure. The dehydrated crystals are honeycombed with regularly spaced cavities interlaced by channels of molecular dimensions. This network of uniform pores and cavities comprises almost 50% of the total volume of the crystals. The empty cavities have a strong tendency to recapture the water molecules that have been driven off. If no water is present, they will accept any molecules that are small enough to pass through the pores into the adsorption cavity.

Polar molecules, in particular, are tightly bound within the crystal lattice and thus effectively caged until released from the Molecular Sieve by the application of heat. By this means, active chemicals can be isolated from systems in which the Molecular Sieve crystals are dispersed until release is desired. This technique permits introducing into rubber formulations many chemicals which would otherwise be too reactive or too volatile to be useful.

The Molecular Sieve powder is very fine and has an ultimate particle size of about one micron to five microns. It is inert and has no effect on the properties of rubber formulations. The powder is free-flowing and disperses readily in rubber mixes.

History of Sieves

These Molecular Sieves were first developed by the Linde Division of Union Carbide Corp. in the late 1940's with the original use being for desiccant service. This is still a major use for these products, but the breakthrough for the rubber industry began in 1955 when the idea of loading these sieves with accelerators or other chemicals was presented and development begun. In May, 1958, Linde made the first public announcement of chemical loaded Molecular Sieves (CLMS) and started promoting their use in the rubber field. Distribution of these CLMS materials for rubber and plastics in the United States is handled by Harwick Standard Chemical Co. as agent for the Linde Division.

Original ideas on the use of these materials in rubber compounding were to provide processing safety during mixing, extruding, calendering, and mold flow by tying up at least part of the accelerator system during these steps and releasing it during the curing cycle. This effect is still a major factor in the use of sieves. Recent work, however, indicates that accelerators loaded on Molecular Sieves can be a very valuable compounding tool in solving problems associated with increasing productivity by using more highly active acceleration systems.

The use of loaded sieves does involve slightly higher cost to the compound with the cost of the sieve and the cost of the loading operation added to the base cost of the accelerator. This is usually a very small percentage of the total compound cost, owing to the very small amounts involved. While even these small added costs may be hard to justify simply for processing safety, a material which can significantly increase production becomes clearly economical.

A number of very successful applications are being used in the rubber industry of these CLMS materials. These include some materials too volatile to be used alone, too viscous for precise weighing, and too reactive for processing safety in the application used.

Silicone Use First

First application of chemical loading and use for curing was made in silicone rubber. The present CW-2015, which is loaded with di-tertiary butyl peroxide, made it possible to use this volatile material to obtain optimum properties of compression set, and better thick section cures, to permit use of carbon black and alkaline fillers, and to reduce backrinding and scorching during molding. This grade is being used increasingly for this purpose. The sieve retains the peroxide in the compound until cure. This material is also available for use in any other polymers as well, of course, where peroxide cures are desired.

Retread Materials

Stocks such as camelback which must be stored for extended periods and shipped long distances are considered outstanding possibilities for use of CLMS acceleration. The need of a faster-curing tread rubber by the retreading industry particularly during periods

of high production such as during the snow tread season has led to active development on a stock containing a CLMS. This would permit the producer to give the same assurances regarding storage life as given for regular tread rubber.

Footwear Compounds

Direct molded footwear stock, which must be very highly accelerated in most applications, many times must be shipped from a rubber mixing facility to the shoemaking plant. One producer of such a stock has been able to make shipments by regular truck of the same stock which had previously required refrigerated trucks by incorporating part of the acceleration on a Molecular Sieve. This permitted more flexibility with regard to shipping times as well as being a less costly operation.

Transfer Molding

Curing time for transfer molded gaskets for automotive windshields has been reduced substantially by one manufacturer. On one compound cure time was reduced from six to four minutes, and on another compound from five to three minutes. In addition to reducing cure time during transfer molding, the chemical loaded sieve releases the accelerator more slowly, permitting better flow characteristics for the compound during the transfer period, and prevents scorch or non-fills in the flowing stock.

Polyacrylic Curing

In the curing of polyacrylic polymers, the use of TETA (triethylenetetramine) which has been adsorbed on a Molecular Sieve provides increased scorch protection and eliminates difficulties with handling and losses during mixing. TETA, normally a hard-to-weigh liquid, is much more easily weighed when in a powder form on the CLMS. Losses due to evaporation, which can affect cure considerably, often occur during mixing on a hot mill. When tied up in the CLMS, however, all of the TETA added to the mix remains available for the curing period.

Tires

In original-equipment tires, curing time has been reduced as high as 30 to 50% in development work, and this reduced curing time shows promise of greatly increasing the production rate without sacrificing processing safety.

Stereospecific Polymers

Although work is only beginning on investigations of the use of CLMS in compounding polyisoprene and polybutadiene, some preliminary results would seem to indicate that these materials, which do differ from natural rubber in curing characteristics, could be cured more quickly with higher activity accelerators, but still maintain processing safety.

Desiccant Uses

An auxiliary use of Molecular Sieves for the rubber industry lies in the basic desiccant property of the material. 4A powder may be used as a water scavenger. This may be utilized in a compound to eliminate the problem of blisters or where moisture might be affecting a chemical loaded Molecular Sieve. This powder may also be used as a water scavenger in frictioning compounds for fabrics used in belt, tire or hose construction to prevent blisters.

Compounding Tool

One of the first things a potential user of chemical loaded Molecular Sieves must do is realize that CLMS is a new compounding ingredient which must be handled on its own terms. It is not sufficient, according to Linde engineers, simply to substitute an equivalent amount of a certain accelerator loaded on a sieve for the same material in an existing formula. The acceleration system must be designed to take full advantage of the sieve action. Each problem should be evaluated on its own merits, and a compound designed to accomplish the desired results. Many materials which were first thought to be incompatible with sieve systems have been found to be workable with a properly designed accelerator system.

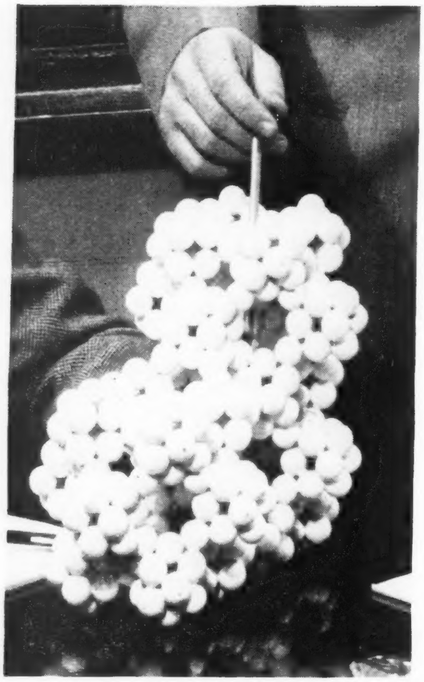
Technical Service Available

The proper design of sieve-containing systems has occupied much of the development work in the Linde laboratory and has led to extensive technical service work on the part of its personnel. The training, experience, and familiarity with these sieves built up through the development and trial years from 1953 have provided the service laboratory staff with the ability to solve some problems on sight and others with properly oriented test programs. This background is available to any company upon application. Proper use of a chemical loaded Molecular Sieve starts with the loading procedure and then includes proper handling and compounding techniques.

Grades Commercially Furnished

In addition to the CW-2015 containing di-tertiary butyl peroxide for silicone curing as mentioned above, there are four other regularly furnished grades. CW-1015 is loaded with piperidine and is suggested for use as a secondary accelerator with thiazole-type primary accelerators. CW-1115 contains di-n-butylamine and is also used as a secondary accelerator with thiazole primaries. CW-3010 with catechol (1,2 dihydroxy benzene) adsorbed gives fast-curing stocks which are very safe processing. It may also be used in neoprene formulations containing carbon black, clay, or whiting pigments. CW-3120, containing 1,3 diethyl thiourea, provides improved processing safety with fast cures in certain neoprene/pigment combinations.

Besides these five basic commercial chemical loaded Molecular Sieves, more than 200 other materials have been successfully loaded on to Molecular Sieves. More



A three-dimensional model of a Molecular Sieve is shown above. Note the pencil extending down into the voids of the model, illustrating the pores and cavities which would contain the chemical

than 30 of these have found application in rubber and plastics or other industries.

Base Sieve Available

In order to provide companies with research or development departments an opportunity to investigate the use of CLMS products in their own laboratories, Linde has announced the availability of base sieve material (Type 13X powder) in limited quantities. Laboratory procedures for loading chemicals on sieves are not too difficult, and two methods have been made public. (See appendix.) These procedures do differ somewhat from the Linde commercial production techniques, but are adequate for most materials.

The limited availability of 13X powder does provide companies with maximum flexibility in loading all chemical types and in design of production methods. Linde engineers suggest, however, that at least initially the company would find it more practical to order the completed CLMS rather than set up its own production facilities. These procedures are set up to enable speedy and complete application development. One point to keep in mind is that even should both laboratory procedures fail to provide a satisfactory CLMS with the chemical in question, the service laboratory might be able to furnish a satisfactory product by using modifications of the procedures taken from past experience.

Processing with Sieves

In general, chemical loaded Molecular Sieves may be incorporated into the mix without difficulty. They disperse well and may, because they tie up part of the active acceleration, permit complete mixing in one step rather than two or more. Storage and handling of these products are very important. Water, even from moisture in the air, will displace the chemical in the sieve with the result that the use of the sieve has been negated. This effect has given considerable trouble in laboratory trials where a technician may weigh out several batches at a time, leaving the sieve in an open container with a large area exposed for hours, overnight, or even over a weekend. This practice will destroy the effect of the sieve considerably, if not completely, and must be avoided. Best procedure is to weigh the sieve into closed containers or polyethylene bags to exclude air.

The problem is not so acute in actual production since usually less time is involved, larger quantities used so that less area is exposed, and often other materials are weighed into the container, covering the sieve thus excluding the offending air. The problem still exists, however, and should be made known to production workers. CLMS products are supplied in sealed five- and 10-gallon containers.

The effect of water displacement has not given trouble in compounded stocks owing to the insulation provided by the rubber. Therefore, the use of sprays or dips for cooling mixed stocks may be employed.

Custom Service

Many of the chemicals tried to date have been prepared at the request of a specific customer to do a particular job. The service laboratory is prepared to accept requests for common or uncommon chemicals to be loaded on sieves. The laboratory expects to be able to furnish the completed CLMS about a week after the chemical is on hand. Many common accelerators are kept in stock, but it would be necessary to order others. It is suggested, therefore, that a request for a rare or little used chemical would be expedited by the customer furnishing the chemical with his request. Initial samples of ½-pound can be prepared, or a minimum 18-pound production-style batch furnished for more complete trials.

For technical service work the customer should include details of the base polymer and the accelerator system. It is also helpful to have some idea of the other ingredients involved. In many cases a customer may supply masterbatch rather than the formula for tests. Linde is willing to enter into secrecy agreements with any customer who so wishes.

Where disclosure of the actual chemical or formula must be kept a complete secret, a chemical may be accepted for custom service if the physical properties are given. These properties should include toxicity, explosiveness, boiling point for liquids or melting point for solids, flammability, and shock hazard. Some corrosive materials cannot be loaded, and the pore size of the sieve also limits the list of applicable materials which may be utilized in this manner.

APPENDIX

Suggested Laboratory Methods for Loading Chemicals on Molecular Sieves

The method best suited for loading a given chemical is determined by the properties of the specific chemical. The following techniques cover loading methods for a wide variety of solids and liquids:

1. Desiccator Method

Liquids and solids which have an appreciable vapor pressure at room temperature or slightly elevated temperatures can be loaded by this technique. Place into a vacuum desiccator a weighed amount of unloaded Molecular Sieve in a container which exposes a substantial surface, such as a Petri dish or an evaporating dish. Care should be exercised to prevent adsorption of atmospheric moisture during weighing. In a separate, similar container, place enough of the chemical to be adsorbed to give the desired weight % loading. Most chemicals can be loaded to about 20 wt-%. Evacuate the desiccator and seal. The rate of adsorption is a direct function of the vapor pressure of the compound being loaded. If the rate of adsorption is too slow at room temperature, it can be increased by placing the desiccator in an oven at an elevated temperature. Caution is advised when you are working with temperature-sensitive compounds, since the heat of adsorption may be sufficient to decompose the chemical. The heat of adsorption will not exceed twice the heat of vaporization.

The weight % loading is calculated from the weight increase of the Molecular Sieve using the following formula:

$$\text{Wt-\% Loading} = \frac{\text{Final Wt. of Molecular Sieve—Initial Wt. of Molecular Sieve} \times 100}{\text{Final Wt. of Molecular Sieve}}$$

2. Solution Method

Non-volatile solids and liquids can be loaded by this technique. The preferred solvents to use are the normal hydrocarbons such as n-hexane, decane, etc. If the chemical to be loaded is only soluble in aromatic hydrocarbons, these solvents may be used. Benzene is preferred over toluene or xylene because it is easier to remove after the adsorption operation. Make a slurry of a weighed amount of unloaded Molecular Sieve in the solvent. The solvent will probably be adsorbed, and the heat of adsorption should be kept under control by carefully adding the Molecular Sieve. While agitating the slurry slowly, add a weighed amount of the chemical to be loaded while carefully avoiding any excessive temperature increase caused by the heat of adsorption. In most cases very little temperature increase will be observed since the chemical will be displacing solvent, and the heat of adsorption will be compensated by the heat of desorption of the solvent. If the maximum loading of active chemical is desired, an excess of this compound can be added to the slurry. If a specific loading is desired, it is necessary to add only the required amount. In some cases it may be necessary to reflux the solvent in order to obtain a reasonable rate of adsorption.

The weight % loading of active chemicals can be determined by measuring the residual amount of chemical remaining in solution after filtering of the Molecular Sieve. With non-volatile chemicals this can be determined by evaporating off the solvent. A more accurate determination of the weight % loading can be made by analysis of the Molecular Sieve of a functional group contained in the adsorbed compound. Analyses for sulfur, nitrogen, amine, hydroxyl, etc., can provide good loading data. Analysis for carbon should not be used since some solvent will be left on the Molecular Sieve and will thus interfere with the determination.

CALENDAR of COMING EVENTS

January 17
Elastomer & Plastics Group, Northeastern Section, ACS. Science Park, Boston, Mass.

January 19
Quebec Rubber & Plastics Group.

January 20-21
Southern Rubber Group. Statler-Hilton Hotel, Dallas, Tex.

January 27
Akron Rubber Group.
Chicago Rubber Group. Furniture Club, Chicago, Ill.

February 7
The Los Angeles Rubber Group, Inc.

February 9
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

February 17
Detroit Rubber & Plastics Group, Inc.

February 24
Quebec Rubber & Plastics Group. Ladies Night. Victoria Hall, Westmount, P.Q., Canada.

March 7
The Los Angeles Rubber Group, Inc.

March 10
Chicago Rubber Group. Furniture Club, Chicago, Ill.

March 17
Boston Rubber Group. Hotel Somerset, Boston, Mass.

March 23
Quebec Rubber & Plastics Group.

March 24
New York Rubber Group. Henry Hudson Hotel, New York, N. Y.

April 4
The Los Angeles Rubber Group, Inc.

April 6
Akron Rubber Group.
Rhode Island Rubber Club.

April 18-21
Division of Rubber Chemistry, ACS. Brown Hotel, Louisville, Ky.

April 19
Quebec Rubber & Plastics Group.

April 21
Detroit Rubber & Plastics Group, Inc.

April 28
Chicago Rubber Group. Furniture Club, Chicago, Ill.

May 2
The Los Angeles Rubber Group, Inc.

May 21-30
American Chemical Society. St. Louis, Mo.

June 2
Quebec Rubber & Plastics Group. Golf Outing. Ste. Hyacinthe, P.Q., Canada.

June 8
New York Rubber Group. Outing. Doerr's Grove, Millburn, N. J.

June 16
Akron Rubber Group. Firestone Country Club.
Boston Rubber Group. Outing. Andover Country Club, Andover, Mass.

June 23
Detroit Rubber & Plastics Group, Inc.

meetings and reports

Ninth Annual Wire and Cable Symposium Stresses New Developments in Plastics

Wire and cable facilities no longer are the main means of communication between major units of armies in the field, but they will continue to be used to back up radio circuits and to provide short-range service, Maj. D. T. Patterson, of the U. S. Army Signal School at Fort Monmouth, told registrants at the ninth annual wire and cable symposium, November 30-December 2.

More than 900 persons were registered for the symposium, held at the Berkeley-Carteret Hotel in Asbury Park, N. J. There were 380 at the banquet the night of December 1.

Look into Future

Major Patterson, in the opening paper of the symposium, "A Present and Future View of the Field Army Wire and Cable Requirements," told the group that present wire and cable furnished for Army use is generally satisfactory, but that research should be done to develop a long-range field wire, similar to the parallel-pair wire W-143 used in World War II, and on a multiquad voice-frequency field cable, which would eliminate the necessity of installing a separate field wire circuit from switchboard terminals to each local telephone.

He also called for continued study on providing a field coaxial cable and a four-wire field wire, the latter to tie in with dial telephone exchanges which would permit automatic switching from any dial telephone in the field army to any dial telephone in the combat zone.

Papers read at the symposium indicated the recent emphasis on use of plastics in wire and cable development work. In the 22 papers, in addition to the introductory paper by Major Patterson, polyethylene was mentioned 12 times; Teflon, three; nylon, once; poly(vinyl chloride), twice. Butyl came in for mention only twice, neoprene twice and silicone rubbers twice.

Rubber Papers

Papers of interest to the rubber industry included the following:

"Cable Splicing Utilizing New Silicone Materials." By R. E. Kincaid, Dow Corning Corp., Midland, Mich.

This paper discussed three materials for splicing which are said to meet demands of ease of application, use in temperatures ranging from —100° to 500° F. without cracking at low temperatures or flowing at high, moisture and chemical resistance, abrasion resistance, good electrical properties retained after exposure, and resistance to sunlight, radiation, and flame. The materials are an unsupported, self-adhering silicone rubber tape available in both triangular and rectangular cross-section; a single component Silastic RTV (room temperature vulcanizing) rubber; and a two-component Silastic RTV rubber.

Working under a simulation of field splicing conditions, testers used three kinds of splices: a poured splice using single component RTV, with a vulcanizing time of one week; a poured splice using a haze of single component RTV topped by two-component RTV, with a vulcanizing time of 48 hours; a taped splice using a base of unvulcanized silicone rubber topped by five layers of triangular tape, with no vulcanization time.

"Silicone Compound Development and Quality Control through Use of the Mooney Viscometer." By Richard M. Savage, silicone products department, General Electric Co., Waterford, N. Y.

This paper discusses use of the Mooney viscometer to determine scorch and cure times of silicone rubbers in a variety of compounds.

"Degradation of Polymers by External Corona Discharge." By R. F. Grossman, Anaconda Wire & Cable Co., Hastings on Hudson, N. Y.

This paper discusses tests on polyethylene, butyl, and neoprene for both ozone resistance and resistance to electron bombardment and concludes that while there is a relation between ozone resistance and corona attack in the case of polymers with residual unsaturation, such as butyl and neoprene, it is variable, and there is no relation in the case of unsaturated polymers such as polyethylene. This paper concludes, therefore, that polymers should be compounded for corona resistance as well as ozone resistance. The existence of carbon-chlorine bonds as in "Hypalon" and poly(vinyl chloride) improve corona resistance.

"Some Recent Studies of Electrical Grade Fillers in Butyl Rubber and Other Insulation Materials." By W. F. Fischer, Enjay Chemical Co., division of Humble Oil & Refining Co., New York, N. Y.

This paper compares properties of platy talc and calcined clay in butyl rubber insulation materials and discusses differences in properties believed related to particle size and shape of the talc fillers.

Howard F. X. Kingsley, deputy chief of the Multichannel Security Branch, Communications Security Division of the United States Army Signal Research and Development Laboratory, Fort Monmouth, N. J., was chairman of the three-day symposium.

Rubber Papers Sought

The Rubber Chemistry Division of the Chemical Institute of Canada will feature a one-day program of technical papers during the Institute's forty-fourth Canadian Chemical Conference and Exhibition scheduled for August 3-5, 1961, in Montreal, P.Q.

The program for the morning session will present general rubber chemistry papers; while the afternoon session will feature papers on textiles as they are applied to the rubber industry.

This CIC conference will be international in character since it will be followed by the eighteenth Congress of International Union of Pure and Applied Chemistry.

Prospective authors of rubber papers should contact Mr. C. M. Croakman, Columbian Carbon (Canada), Ltd., 7 Superior Ave., Toronto, Ont., Canada, who is in charge of the Rubber Chemistry Division's program.

Rawood, Ltd.

G. E. Beharrell proposing a toast at the Symposium dinner. On his left, Lady Melville, and on his right, Sir Harry Melville, Mrs. G. E. Beharrell, and A. J. Pickett

Banquet, Papers on Special Polymers End London Synthetic Rubber Meeting

The Second International Synthetic Rubber Symposium organized by *Rubber and Plastics Age* and held in London, October 11, 12, and 13, was featured by a Symposium dinner on the evening of the second day. The papers presented at the sessions on the final day dealt with special polymers, some new and some not so new, but the information on the latter dealt with the latest developments with these older specialty polymers.

This concludes our "on-the-spot" report of this international meeting, which attracted 900 registrants from all over the world. The opening ceremonies and the papers presented on the first two days of the Symposium were described in the first part of this report, which appeared in our December issue.

The Symposium Dinner

The Symposium dinner was held at the Savoy Hotel on the evening of October 12 and was a gala affair attended by about 500 registrants and their ladies.

After dinner and a toast to Her Majesty the Queen, the chairman of the Symposium, Mr. Beharrell, proposed a toast to research and to the speaker of the evening, Sir Harry Melville.

Mr. Beharrell emphasized that the problem of research today turns on the comparisons which are made about the vigor of research in various countries. The more spectacular outflows of space research sometimes give the impression that the United Kingdom and some other Western countries have fallen behind in this field, but for the moment there is no evidence to show that this is true. What is important is that we should not regard our research needs with indifference. It would be a grevious error if we allowed our relative industrial maturity to lull us into any kind of apathy or complacency, he continued.

Increasing economic well-being is correlated with the amount spent on research, and even if this correlation is too facile, there is no doubt that in today's complex industrial community technological progress is more likely to result from systematic study than anything else, Mr. Beharrell said. Research, like many other things, is subject to certain relentless facts of life, however: and it was suggested that being practical about research expenditures was as much of an advantage to the scientist as to the salesman.

In paying tribute to Sir Harry Melville, Mr. Beharrell said there could be no higher praise than the fact that while Sir Harry occupies the high administrative position in the Department of Scientific and Industrial Research, he still finds time to maintain his knowledge and interest in polymer research. Not only that, but his integrity of mind and manner is in no way compromised by a sturdy grasp of practical realities. There is no better name than his to associate with a toast to research, Mr. Beharrell concluded.

Sir Harry Melville, in his response, thanked Mr. Beharrell for proposing the toast to research and coupling it with his name. It was not so long ago that research done in industry, in the universities, and in government was conducted behind closed doors, not so much purposely, but because the public in general took very little interest in what went on, he explained. The reason was this research had very little bearing on the public at large, but that pattern has changed very considerably since the last war, and the impact of the scientist on everyday life is now something to be reckoned with.

The research effort in the United Kingdom in 1959 involved an expenditure of about £500 million a year, and the scientist must be fully aware of the impact of his work on the community at large, he continued. At the same time the scientist must realize his responsibilities for the direction of research work so that the general public will be convinced that his advice and the direction of research efforts are such that the community at large will benefit.

In the earliest days of synthetic rubber research, the chemists involved could not completely appreciate the importance of the discoveries and developments they made since the science of high polymers was not as yet known. This situation is now completely changed, and the Second International Synthetic Rubber Symposium is an excellent illustration of the way in which fundamental science and technological activities have come together in a manner which is almost unique in many branches of science, it was said.

This Symposium has indicated the tremendous necessity for cooperation among a number of people to achieve an end result, but the speaker said he hoped there was still an opportunity for the lone scientists since often the lone worker does seem to get a breakthrough in cases where large teams with all their facilities sometimes fail to do the job. In conclusion, Sir Harry made a plea for maintaining a balance between these two methods of doing research work in the high polymer field, and said that he felt that the Symposium had indicated the necessity of both kinds of approach.

A. J. Pickett, editor, *Rubber and Plastics Age*, thanked Sir Harry for his talk and then introduced those seated at the head table. Mr. Pickett mentioned that 17 countries were represented at the Symposium and called attention to the Gold Medal Award for outstanding services to the synthetic rubber industry that his publication had just established. He thanked the members of his staff for their efforts in connection with the Symposium and Exhibition and paid special tribute to the work of Dr. L. P. Smith, technical editor, for his special efforts in connection with the Exhibition, which featured about 100 rubber product, materials, and machinery and equipment firms.

Mr. Pickett thanked Mr. Beharrell for his contributions to the Symposium as chairman and then proposed a toast to the guests.

David Radford, chairman of the British Plastics Federation, in responding to the toast to the guests indicated that the plastics industry in the United Kingdom would be working more closely with the rubber industry in the future through the Research Association of the British Rubber Manufacturers.

Dr. I. Drogin, vice president, United Carbon Co., in his response for the guests from abroad expressed appreciation for the finely organized Symposium and Exhibition. He said that the papers presented had broadened the knowledge on synthetic elastomers and given new insight into the science and technology of these materials. Dr. Drogin added that the Symposium had provided a welcome opportunity to meet old friends and make new ones, and that he was looking forward with anticipation to the Third International Synthetic Rubber Symposium.

October 13 Sessions

Dr. Harry Barron, managing director, Corrosion, Ltd., was the chairman for the October 13 sessions. Dr. Barron provided a summary of the Symposium at the end of the afternoon session.

"Vulcanization and Elastomeric Properties of Ethylene-Propylene Copolymers," by G. Natta and G. Crespi, both of Istituto di Chemica Industriale del Politecnico, was the first paper of the morning session and was given by Dr. Crespi because of the absence of Dr. Natta.

The ethylene-propylene copolymers obtained with some active catalysts, with anionic coordinated mechanism, show a statistical homogeneity, have a regular linear head-to-tail structure and an easily regulated high molecular weight, it was said. Owing to their viscoelastic properties, they must be considered as very interesting raw materials, suitable for several applications in the elastomeric field. Excellent rebound properties, very low brittle point, together with high aging stability, connected with their chemical nature of substantially saturated hydrocarbons, are the most significant characteristics of this new type of elastomer.

The cross-linking of ethylene-propylene copolymers, owing to their saturated nature, cannot be effected by the usual methods used with unsaturated synthetic rubbers unless a certain number of double bonds are introduced in macromolecule. Free radicals (e.g., produced using non-volatile organic peroxides) especially in the presence of small amounts of sulfur, allow cross-linking of these new saturated elastomers, operating under thermal conditions which are very similar to those usually employed for other rubbers. The addition of sulfur gives better vulcanizate physical properties with respect to the amount of peroxide employed, and a higher degree of cross-linking.

Data were presented on the physical and chemical properties and on the chemical and aging resistance of EP rubbers cured with reinforcing agents in comparison with similar compounds for other rubbers.

"Preparation and Properties of Chlorobutyl," by F. P. Baldwin, Esso Research & Engineering Co., Linden, N. J., was given next. Dr. Baldwin said that studies of the chlorination of butyl rubber with elemental chlorine at about 25° C. reveal that the primary and preferred reaction is one of substitution at the isoprene residue. The reaction is very sensitive to halogen level, and, unlike bromination, chlorination beyond one chlorine atom per isoprene residue leads to rapid polymer degradation.

The incorporation of reactive allylic chlorine into the butyl rubber molecule provides for numerous vulcanization modes. Cross-linking can be effected not only by conventional sulfur/accelerator combinations, but also by bis-alkylation reactions. Zinc oxide and certain organic zinc salts are also effective cross-linking agents.

Because of the diversity of curing methods available, vulcanizate properties can be made to vary widely. Co-vulcanization with and adhesion to other rubbers are possible, and compounds having excellent resistance to dynamic flexure and heat exposure are readily prepared.

The increase in cure rate and the new range of cured properties available with this rubber foretell expanded application areas for butyl-type polymers. Tubeless tire innerliners, protective veneers, heat-resistant belting and hose, non-contaminating tubing and tanks, and miscellaneous quality mechanical goods items are examples, it was said.

"Modern Nitrile Rubber Technology," by I. W. E. Harris and H. A. Pfisterer, Polymer Corp. Ltd., Sarnia, Ont., Canada, was the next paper on the program. Mr. Harris explained the history of the development of nitrile rubbers up to the introduction of the low-temperature types in Canada in 1950. The basic properties controlling the behavior of nitrile rubbers were discussed with special reference to the effect of non-polymer components on the color and curing behavior of the rubber and the effect of Mooney viscosity and acrylonitrile content on the processability and vulcanizate properties.

Polymer-polymer incompatibility and the consequent presence of one polymer component as a micro-disperse phase were shown to improve processability and, in some cases, the vulcanizate properties. Examples of this phenomenon were drawn from the application of rubbers as plasticizers for thermoplastic resins and the use of a cross-linked nitrile rubber as a processing aid. Compounding principles that provide improved heat resistance and ozone resistance were described.

"High Solids SBR Latex by a Chemical Promoted Agglomeration," by E. L. Borg, L. H. Howland, E. J. Aleksa, and R. W. Brown, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn., was presented next. Mr. Borg pointed out that for many applications, particularly in the manufacture of foam sponge, a high solids, large particle size synthetic rubber latex is required. The preparation of such a latex by direct polymerization is slow and costly in contrast to the preparation of a small particle size latex, which is rapid. The small particles in a latex made by rapid polymerization can be agglomerated to the large size required in high solids applications by the use of a colloidally active chemical.

Polyvinyl methylether is particularly effective for latex particle agglomeration, and its utility is enhanced by a close control of its molecular weight and structure. A practical application of PVME to the post-polymerization agglomeration of small particle SBR latex has been made, and a commercial large particle, high solids latex is produced in this way.

This 70% total solids, 2500 Angstrom unit particle size latex is particularly useful in the manufacture of foam sponge and for other applications where its features of large particle size, high solids, and low viscosity are desirable properties, Mr. Borg concluded.

"Elastomers for Advanced Design Flight Vehicles," by R. E. Headrick, Wright Air Development Division, Wright-Patterson Air Force Base, Ohio, was presented next. Mr. Headrick's paper was concerned specifically with the behavior of elastomers under a wide variety of environmental conditions, including extremes of temperature and pressure, nuclear radiation, and resistance to the degrading action of solvents and chemicals including the various liquid fuels and oxidizers. Tailor-made polymers are considered as one important approach for the development of rubber compounds for the solution of these extremely complex problems.

A few of the more promising elastomeric polymers, such as flurocarbons, silicones, etc., were discussed with special reference to the inherent problems and limitations of the polymer systems. High-temperature elastomers for tires, elastomers for sealants, and tailor-made polymers with high radiation resistance were included in this discussion. The importance of polymer research as the only approach to the achievement of the "ideal elastomer" was emphasized.

"The Mechanism of the Post Cure of 'Viton' A Fluorocarbon Elastomer," by J. F. Smith and G. T. Perkins, Du Pont Elastomer Chemicals Department, Wilmington, Del., followed the paper by Mr. Headricks. Dr. Smith reviewed the presently available methods for the vulcanization of "Viton," all of which require a long, high-temperature post cure in order to develop maximum properties.

The necessity of the post cure of "Viton" was explained in the following way: The formation of cross-links during vulcanization is accompanied by the elimination of hydrogen fluoride from the polymer. The reaction of HF with MgO present as an acid acceptor then forms water which acts to inhibit the full development of cure unless it is removed from the vicinity of the polymer by post cure in an open system. Measurement of the rate of eli-

mination of water from the polymer serves as a method of following the development of cross-links during cure.

Approximately two moles of water, derived from four moles of HF, are associated with the use of one mole of diamine curing agent. This ratio is confirmed by independent estimates of the relation of cross-link density to curing agent level, made by measurements of swollen compression modulus.

"Silicone Rubber Compounding," by P. C. Servais, Dow Corning Corp., Midland, Mich., and I. H. Riley, Midlands Silicones, Ltd., London, England, was the final paper on the program. The advantages and disadvantages of silicone rubber compounding by rubber processors and the reasons for the increase in this aspect of the silicone rubber business were discussed.

A comprehensive review was made of the materials available to the processor, and indications were given of the ways in which the properties of the rubber could be changed by suitable choice of fillers, additives, and curing agents. The relative merits of compounding from gum or gum-filler masterbatches were discussed.

A brief description was given of the equipment required for silicone rubber compounding and of the recommended methods of working.

Walter A. Lee

Lord Hailsham viewing the Exhibition with Mr. Beharrell, *center*, and Dr. L. P. Smith, *right*

Symposium Summary

Dr. Barron in his summary of the papers presented at the Symposium first pointed out that at the 1957 meeting, stereospecific elastomers were very new, and there was no commercial production contemplated; whereas now a production of at least 200,000 tons a year in the United States and 100,000 tons a year in Europe and elsewhere is contemplated. The 1960 Symposium marks a turning point in synthetic rubber's history, therefore, in the development of commercial production of stereospecific solution elastomers, while the polymerization of synthetic rubbers by aqueous polymerization continues on an enormous scale at the same time. Also, there was the suggestion of the production of butyl rubber in much larger quantities followed by the ethylene-propylene copolymer rubbers in the near-term future, he added.

Dr. Barron said he thought the Symposium made a great contribution toward a better understanding of the mechanism of polymerization, and he complimented Professor Bawn on his description of solution polymerization which made everybody familiar with what was being done and why. Quite clearly, the most significant feature has been the arrival of the metallic complexes available in solution form which enables full advantage to be taken of the stereoregular polymerization, Dr. Barron said.

Reference was made to the papers on *cis*-polyisoprenes and *cis*-polybutadienes, which were accompanied by papers on the processing of the new materials and which described some of the difficulties in this connection. In general, the implication is that the use of these new materials still involves the use of small amounts of natural rubber although in one paper Dr. Engel stated quite categorically that *cis*-polybutadiene would now be used in all fields where natural rubber is being used, and Dr. Barron took special note of the prediction of Dr. Engel for the bulk polymerization of *cis*-polybutadiene by the extrusion process. It was suggested that such bulk polymerization represented a complete breakthrough of the natural rubber barrier and would be of further aid in setting a definite ceiling on natural rubber prices.

It was pointed out that there was only one paper on SBR presented, but that this might be due to the fact that SBR is now a standard form of production on a very large scale, and one almost thinks of it in the same way as one thinks of natural rubber.

One cannot help feeling from the sense of the papers that the next stage of development and possibly one which

Walter A. Lee

A view of two of the booths at the Exhibition

will be covered by the next Symposium will be the discovery of new catalysts in aqueous systems which will give stereospecific polymers, Dr. Barron said. He next mentioned the papers on nitrile, fluorocarbon, and silicone rubbers and the urgent problems associated with the use of many of these materials for aircraft and missile work.

In concluding his summary, Dr. Barron referred to a statement made by one of the lecturers that from the beaker to the plant involves many problems. Although the lecturer did not elaborate on this point, Dr. Barron said he was obviously someone interested in the production of raw materials, and that the users of basic raw materials would in their turn say that this is exactly where their problems start.

X-Ray Tire Inspection

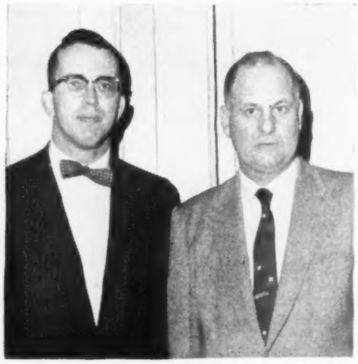
Raymond Lindert, of Armstrong Rubber Co., West Haven, Conn., discussed the use of X-ray inspection of tires at the November 18 meeting of the Connecticut Rubber Group, held at Rapp's Paradise Inn, Ansonia, Conn. There were 226 members present.

Lindert told the Group that X-ray units have been bought for each of Armstrong's three tire production plants. When the three units are in full-scale operation, each type of tire produced by Armstrong will be X-rayed on a sampling basis, and every test tire produced will be X-rayed before and after testing. He further said that periodic removal of test tires from test wheels for X-ray pictures gives a series of sequence pictures of what happens in tire failure, giving development researchers a better idea of how to improve tires.

Unlike with medical X-ray, where the patient cannot be subjected to excessive radiation, the tires inspected can be X-rayed repeatedly, and under modern methods of X-ray xero-radiography, the X-ray picture is developed in seconds; the plate can then be cleaned and reused.

The speaker declared that Armstrong is using X-rays instead of ultrasonic equipment for detecting separations in new tires because the sound method is too slow, because the variation in sound transmission due to the extensively siped pattern of Armstrong tires is greater than that caused by small separations, and because the internal and external lubricants used in curing tires made a complete wetting of the surface difficult.

Ralph Houk, manager of the New York Yankees baseball team, also spoke, telling the Group that the creation of two new American League teams and the impending player draft by those teams make it difficult to estimate at present just what players he will have at the start of the season. Loss of players due to the draft will probably cut down the number of trades, he said.



Raymond Lindert, *(left)*, with V. P. Chadwick, chairman of the Connecticut Rubber Group

Allied Chemical Corp. Renames Polyethylene

When Allied Chemical Corp., New York, N. Y., combined the Semet-Solvay petrochemical division with the plastics and coal chemicals division to form the new plastics division, a change in designation of the low weight polyethylene was necessary to standardize the line. The products remain the same, but the names now conform to the system until now used only by the Semet-Solvay division.

Old and new grades are as follows:

Old P & C C	Form	New Plastics Division No.
8406	Pellet	AC-6
8416	Powder	AC-6A
8407	Pellet	AC-617
8417	Powder	AC-617A
8429	Pellet	AC-629
8430	Powder	AC-629A

Group's Holiday Fetes

Boston Rubber Group

More than 600 members of the Boston Rubber Group gathered on a very nasty night to enjoy the cocktail hour, banquet, and entertainment of the Group's Christmas party. In spite of an all-day rain, which turned to snow shortly before the party began, very few who had planned to attend changed their minds and stayed away. The party was held at the Somerset Hotel, Boston.

The attendees were treated to either a turkey or lobster dinner and a show including singers, dancers, and a juggler of national reputation. The party concluded with the typical Boston fast-serve door-prize competition with about one out of three persons qualifying for a prize.

New York Rubber Group

Approximately 475 persons were present December 16 at the annual Christmas party of the New York Rubber Group, held at the Henry Hudson Hotel, New York, N. Y.

The program included a cocktail hour, dinner, and a variety show following, with acts including a male quartet, female singer, banjo player, and magician. The only item of business was presentation to R. B. Carroll, 1959 chairman of the Group, of a certificate commemorating his service.

An array of door prizes was given out, ranging from luggage and radios to a pair of folding oars. About one prize was given out for every four persons.

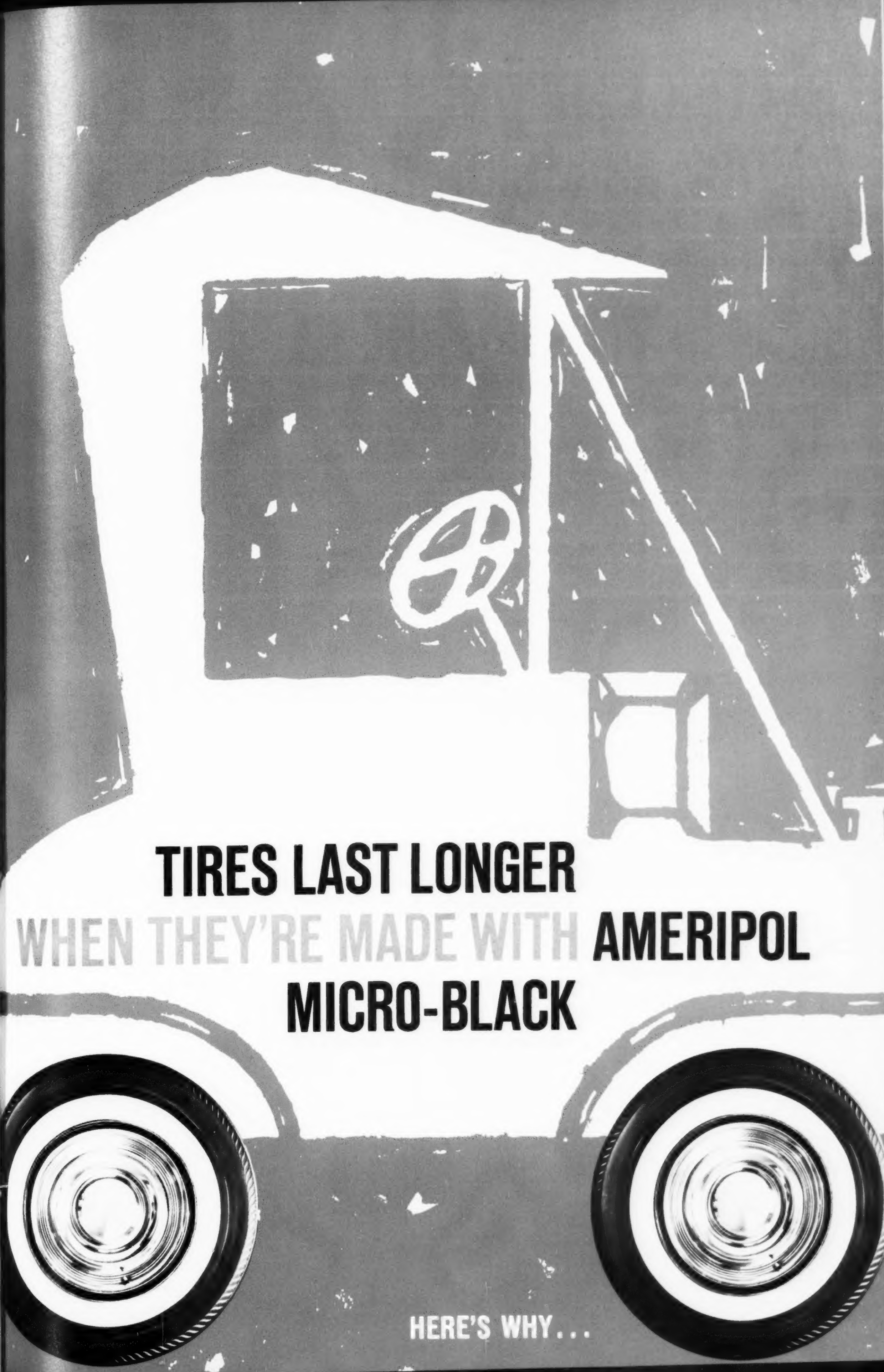
Lectures on Reclaim

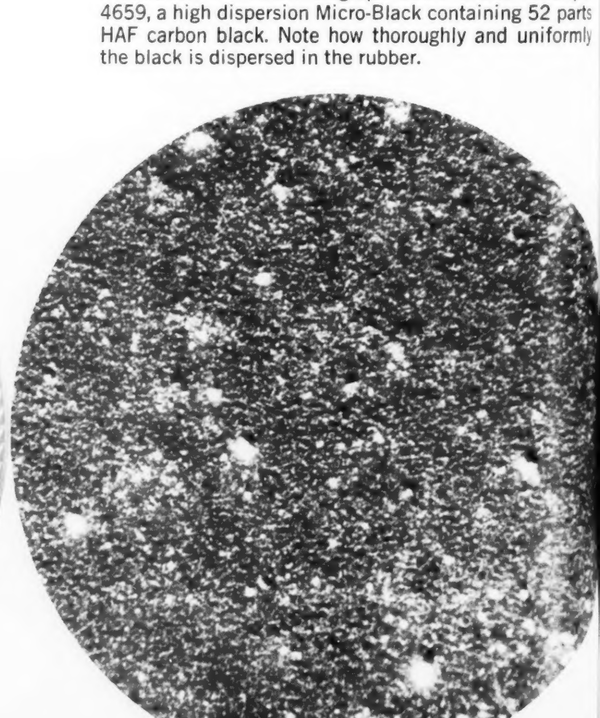
The National College of Rubber Technology, London, England, is holding a 10-week series of weekly lectures on reclaimed rubber with the cooperation of the Association of British Reclaimed Rubber Manufacturers. The series began January 9 and will continue through March 13.

The schedule follows: January 9, "Development of the Reclaiming Industry, Part I," John Ball, lecturer; January 16, "Development of the Rubber Industry, Part II, Scrap Rubber," R. C. Tonn, lecturer; January 23, "Reclaiming Processes, Part I," W. A. Tandy; January 30, "Reclaiming Processes, Part II," W. Salisbury; February 6, Mechanism of Reclaiming, Part I," R. J. Ceresa; February 13, "Mechanism of Reclaiming, Part II," R. J. Ceresa; February 20, "Evaluation of Reclaimed Rubber," J. Donnelly; February 27, "Applications of Reclaiming Rubber in Non-Tire Products," J. Westhead; March 6, "Applications of Reclaimed Rubber in Tire Manufacture," J. L. Bloxham; March 13, "The Future of Reclaimed Rubber," W. E. Stafford.

Fort Wayne Group

R. C. Deskin, E. I. du Pont de Nemours & Co., Inc., spoke on "Some Recent Developments in 'Viton' Compounding," at a meeting of the Fort Wayne Rubber & Plastics Group, December 1, at the Van Orman Hotel, Fort Wayne, Ind. There were 216 members present for the talk and a smorgasbord dinner which preceded it.


TIRES LAST LONGER
WHEN THEY'RE MADE WITH AMERIPOL
MICRO-BLACK
HERE'S WHY...



Compare the uniformity of carbon black dispersion in Micro-Black (illustration 1, extreme left) with a counterpart formula, dry-mixed (illustration 2) and a slurry-mixed black masterbatch (illustration 3).

Micro-Black's micron-size particles are thoroughly dispersed in the rubber by an exclusive process—high liquid shear agitation at the latex stage. Result: tires and other products made with Micro-Black have controlled uniformity, superior dispersion, and greater abrasion resistance.

Photomicrographs shown here were made by Dr. Raymond P. Allen of Akron, Ohio, well-known Consultant in Industrial Microscopy. They are certified to be exactly as shown (100 times magnification) and unretouched.

CHOOSE AMERIPOL MICRO-BLACK FOR YOUR RECIPES AND YOU GET NOT ONLY A BETTER END PRODUCT, BUT ALSO:

Savings in time—Since the black is already in the rubber, you eliminate one weighing operation, one mixing operation, and shorten other mixing operations.

Savings in equipment—Elimination of the carbon mixing operation frees equipment for other uses and makes possible increased production without additional investment.

Savings in power—Fewer mixing operations, plus shorter mixing cycles, mean lower power consumption for the same volume of production.

Savings in inventory costs—You purchase and handle only one material—Micro-Black—instead of two—rubber and carbon black. And you need no extra storage space for carbon black, since it's already in the rubber.

Illustration 2—A conventional dry mix masterbatch containing 52 parts HAF carbon black.

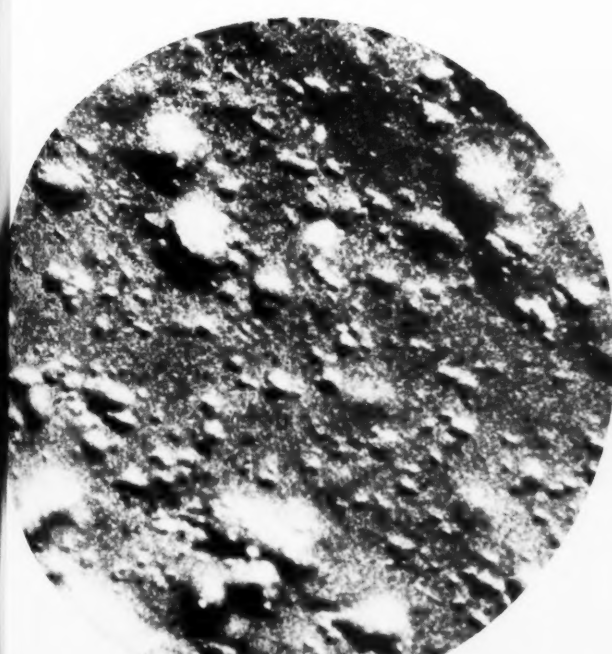
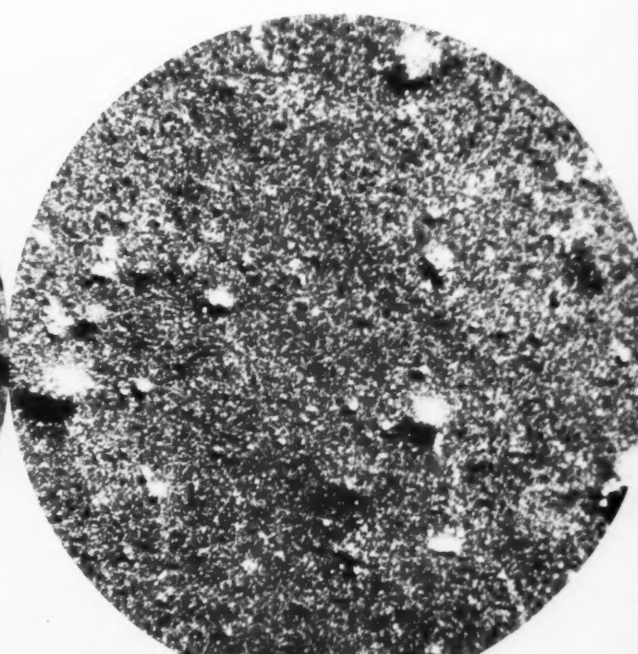


Illustration 3—A black masterbatch containing 52 parts HAF carbon black, mixed by competitive slurry method.



German Rubber Society Congress Concludes with Many Fine Papers

The meeting of the German Rubber Society held in West Berlin, October 4-8, 1960, has been reported in our November and December issues. We conclude our on-the-spot report of this fine meeting with abstracts of papers on fillers and vulcanization, aging, technology and production, and elastomers and testing.

Included with this final section of our report are two pictures taken during the boat ride on the Harvel Lakes on the evening of October 5, sponsored by Phillips Petroleum International Corp. A social evening by Phillips has become traditional at meetings of the German Rubber Society.

Abstracts of Papers (Concluded)

Fillers and Vulcanizates—II

Reinforcement of Natural Rubber by Carbon Black and High Energy Radiation. A. and G. Lamm, both of Paris, France.

The authors report on investigations to reinforce natural rubber latex with aqueous dispersions of carbon black by irradiation with gamma rays. The tests confirm that reinforcement is due to the creation of radicals in the rubber and to a lesser degree also in the black; at the same time irradiation of the ingredients resulted in the obtaining of films with considerably better mechanical properties than for non-radiated materials. Separate irradiation of both the latex and the black gave best results, which were further enhanced by heating two hours at 100°C. without vulcanizing agents. Irradiation of films cast from latex/carbon black mixes after the films were dried in air at room temperature also yielded interesting results, though slightly inferior to those obtained by irradiation in the latex state. Radical acceptors such as oxygen and hydroquinone, and curing agents, inhibit the effect of radiation.

Studies on the Reinforcing Effect of Fillers in Vulcanizates. F. Glander, Hannover, Germany.

The observation that density values of carbon black and of white fillers, determined volumenometrically, in many cases deviated to a greater or smaller extent from those obtained by other methods, but that these differences paralleled the degree of activity, reinforcing effect, etc., of the respective fillers, led to a method for a first estimate of these properties of fillers. The method, which is simple, quick, and requires very little material, is described and its usefulness illustrated by examples. The relation is shown of the volumenometrical data with increase in weight of dried carbon blacks exposed to moist surroundings. Reference is also had to results of chemical-analytical determinations, which suggest the presence of chemical bonds in reinforcement.

Relation between the Physical and Chemical Structure of a Silica and Rubber-Technological Properties. W. H. Albrecht, Duren, Germany.

Measurement of particle area is recognized as a means of determining the activity of silicic acids. The author compares measurements obtained by various methods with results of physical tests on silicic-acid filled rubber, in order to arrive at a clearer understanding of the relation of area of silicic acid to its effect on rubber. After first briefly covering the influence of the chemical properties of various silicic acids on vulcanizates, he concentrates chiefly on the BET gas adsorption method of determining area, the Carman method based on the flow of gases through porous media, and the electron-microscope method. He reports on work to simplify and speed up tests by combinations of methods and concludes that the Carman test is particularly suitable for rapidly defining the fitness of a known, highly active silicic acid, but that the BET method should be used for silicic acids of unknown origin.

Role of Carbon Structure in the Reinforcement of Rubber—The Effects of Lowered Structure. C. W. Sweitzer, Columbian Carbon Co., New York, N. Y.

In the effort to develop tires with maximum wear the tire compounder is constantly forced to compromise in the choice of reinforcing carbon blacks. The attainment of maximum wear must be balanced against increased problems in processing, hysteresis, and performance properties of the tire other than wear. In a previous paper the advantages of higher structure carbons for increased wear were demonstrated. In recent years more attention has been given to these other performance properties of the tire, and carbon blacks were sought that would give the desired improvements. Investigations indicated that reinforcing carbon blacks of lowered structure would provide the desired properties. Various methods are available for the manufacture of carbon blacks of lowered structure, but they vary in their practicability and flexibility. Recently carbon blacks of these desired properties have been developed, and the tire compounder now has that wider choice of reinforcing carbon blacks required to meet the various tire performance problems.

Experience with Rubber/Carbon Black Batches. P. Bernemann, Marl-Huls, Germany.

After reviewing the history of the production of rubber/carbon black batches, the author details the work leading to the development by Chemische Werke Huls of its own experimental procedure. The various steps are fully dealt with—the mixing of finely divided carbon black dispersions with latex/oil emulsions, immediately followed by precipitation — and the modifications are described by which the method was improved. The favorable results led to a modern, automated plant with monthly output of several hundred tons of materials said at least to equal similar American products. Tests on the properties of black batches and the factors influencing properties are critically examined, and the pros and cons of such batches for producer and consumer are considered.

Vulcanization of Natural and Synthetic Rubber by Resins. C. Thelamon, Paris, France.

The resins used in this study of vulcanization of natural and synthetic rubbers were: Schenectady SP 1045 (dimethyl phenol) and Schenectady SP 1055 (alkyl bromomethyl phenol formaldehyde). The resins were compared with dicumyl peroxide and a system of sulfur vulcanization, in mixes containing an HAF black and a colloidal silica. Both resins confer properties close to those obtained with dicumyl peroxide and in addition give low permanent set. But in the case of natural rubber, aging must be improved. The results with butadiene/styrene copolymers are less interesting: permanent set, in particular is not so satisfactory as with the other elastomers.

Phenol Resins as Curing Agents. A. Giller, Wiesbaden, Germany.

American investigators have shown that vulcanization of butyl rubber with alkyl phenol resin can be considerably accelerated with a metal chloride, like $SnCl_4.2H_2O$, or halogen-containing elastomers and ZnO. The author described work undertaken to discover why the combination butyl-halogen containing elastomer/ZnO is less effective than the combinations butyl/metal chloride. It was found that mixes containing halogen and ZnO vulcanize much more readily if they are hot-milled before the resin is incorporated, but that larger amounts of ZnO or other zinc compounds have a retarding effect. Further research revealed that by using the powerful alkyl phenol resin Sr 1571.11c, the ratio resin/butyl can be reduced to 3:100 parts by weight, whereby aging of the vulcanizate is improved, and costs of the formula are reduced. Similar results are obtainable with butadiene/styrene rubber and alkyl phenol resin. A theory is developed for the acceleration of resin vulcanization according to which the

On the Phillips Petroleum International Corp. boat ride on the Harvel Lakes on the evening of October 5, *left to right*, R. E. Metzger, General Tire & Rubber Co., Amsterdam, Holland; R. G. Seaman, RUBBER WORLD; R. B. Robitaille, Phillips Petroleum International, Milan, Italy; P. W. Grange, *Rubber and Plastics Age*

metal chloride reinforces the polarizing effect of active fillers on the double bond of the elastomer, after which action the activated rubber reacts with the resin; the higher temperature due to hot milling increases the effect of the metal chloride.

Technology and Production

Researches into Productivity Measurements in the Rubber Industry. W. C. Wake, Research Association of British Rubber Manufacturers, Shawbury, England.

Interfirm comparision is a most useful method of studying productivity and has been applied to the rubber industry, though on a limited scale. There are several possible approaches to the question, what sort of measurement should be made. The analytical approach involves the use of an overall measure, say total weight of output in relation to manhours of work, followed by a stage-by-stage breakdown to reveal source of differences. The synthetic approach starts at the individual process and builds up to a final figure of comparative merit. The paper discusses in detail the components of mill-room productivity and methods of assessing such things as the diversity of compounds and materials used. The final sections of the paper deal with operating ratios, sometimes called management ratios, and stress the importance of using a measurement for interfirm comparision appropriate to the training of the person to whom the report is made.

Helical Flow in Extruded Goods. S. Eccher, Milan, Italy.

After a general exposition of flow problems, particularly in rubber, the author describes a study of flow on profiles of different shapes and dimensions, produced by feeding variously colored mixes successively into the extruder. The zones of color change exhibited a peculiar appearance in longitudinal section, assumed to be due to the eccentricity of the end-section of the screw channel which, while turning about the axis of the screw, feeds a charge of helical profile to the extruder head. Results with transparent mixes confirm this assumption, thereby proving the existence of a helical structure in the interior of the profile; certain irregularities in profiles, it is added, can be shown to be caused by this structure.

Mechanical Strength of Conveyor Belts in Relation to Definite Defects. A. Matting, Hannover.

Test methods based on observations in practice and data in the literature on stresses which conveyor belts undergo in use yielded no definite conclusions as to their in-service behavior. Further tests were therefore undertaken under conditions chosen better to reflect those of actual use: samples were first subjected to preliminary stresses or purposely made defective (fabric crushed or punctured; edges of the belts notched) and then to repeated impact, alternating bending, and tensile tests. Results seem to indicate that values are most affected by punctures in the fabric; preliminary stresses affect values in intermittent flex tests when the number of flexings is high.

An Economical Method of Producing Latex Foam. A. Sila and J. Leveque, Paris.

In order to meet the competition offered by plastics foams, the price of latex foams is reduced by reducing latex content, but the usual methods also lower quality. At the Institut Francais du Caoutchouc, Paris, two improved processes have been developed; one is based on the stiffening of latex foams by starches unsolubilized by tannins; the other uses bitumen emulsions as extender; the two methods may be combined for maximum economy. The process is simple, and the usual equipment and methods of producing foams are retained. The products either show better properties at the same price as pure latex foam, or offer the same qualities at a lower price. If latex foams are to have a large market, however, research must discover a process by which it would be possible to reduce their density by half without impairing their usual properties.

Properties of Vulcanizable Systems of Rubbers and Thermoplastics. C. L. Bryant, Welwyn Garden City, England.

The blending of rubbers and plastics creates new materials which have different and in part improved properties, as compared with the initial materials. Thus copolymers of butadiene and styrene have long been known and find ever-wider technical applications. Depending on the proportions of the two monomers, copolymerization yields either resinous materials or the familiar SBR rubber-like products.

The addition of small amounts of natural or synthetic rubber improves calendering properties of polyethylene. In the manufacture of marine cables, the addition of butyl rubber or polyisobutylene yields compounds of practical importance.

Completely new and economically interesting effects were discovered when PVC was plasticized with nitrile rubber. This generally resulted in thermoplastic compounds. Those in which a larger proportion of nitrile rubber is modified with a smaller proportion of PVC can be vulcanized and have the properties of a vulcanized rubber. The chief characteristics of such mixes are that some of the desirable properties of PVC enter into effect in the end-product.

The above by no means exhausts the possibilities of blending rubber with plastics; it may safely be predicted that additional combinations will be developed.

New Principles for Calculating Properties of Rubber V-Belts. K. H. Bussmann, Berlin-Dahlem, Germany.

Because of the tremendous development in V-belts, the calculations in the DIN 2218 specifications of 1941, still valid in Germany, have had to be revised, and experiments carried out at the Federation Institution for Testing Materials are reported. Practical needs were taken into consideration in the tests which were divided into two large groups: energy tests to determine adhesion of the belt to the disk, and elongation or tensile tests emphasizing resistance to disruption under repeated stresses. Apparatus used is described, and a method of calculation is explained by which standard values can be established which also take into con-

sideration the effect of flex frequency, of disk diameter, and other factors, as well as of life.

Aging

Oxidative Stress Relaxation Studies of Radiation Cured Vulcanizates, with and without Antioxidant. J. R. Dunn, British Rubber Producers' Research Association, Welwyn Garden City, England.

The oxidative aging of purified rubber cross-linked by γ-radiation both in the atomic pile and in the electron beam has been studied by measurements of continuous and intermittent relaxation. Degradation at 70-100° C. in air has been shown to proceed through autocatalytic scission of the polyisoprene chains which is markedly retarded by phenolic antioxidants and particularly by dithiocarbamates. The data obtained at 85 and 100° C. accurately obey the force-time relationship

$$\frac{f}{fo\text{-}f} = \frac{a}{t} - b$$

which is predicted for degradation during an autoxidation chain similar to that occurring in olefins. This behavior was exhibited by peroxide vulcanizates which also contain carbon-carbon crosslinks.

Conventional antioxidants and rubber soluble dithiocarbamates or dithiophosphates inhibit the cross-linking reaction and give rise to a softer product for a given radiation dose. By virtue of their acting as inhibitors of cross-linking the concentration of these materials is reduced during radiation curing, and their subsequent lifetime as antioxidants is therefore reduced. The less soluble dithiocompounds of lower molecular weight do not inhibit the cross-linking reaction, and their concentration after cure is unchanged. Certain of these are sufficiently soluble to inhibit autoxidation, and their efficiency in that capacity is unchanged. The most efficient antioxidant for introduction at a concentration of 1% into mixes for radiation vulcanization is zinc-dimethyldithiocarbamate. This does not affect the cure, and it protects the vulcanizate against oxidative degradation at 100° C. for considerably longer than any of the other materials investigated, including zinc dibutyl-dithiocarbamate which would be comparably efficient if introduced from solution after cure.

Experiments involving introduction of Tinuvin 'P' before cure show that transparent radiation vulcanizates may be protected from photochemical degradation by the addition of U. V. absorbers.

Antiozonants in Oil-Plasticized Rubber. Th. Kempermann and R. Clamroth, Leverkusen, Germany.

The efficiency was investigated of 23 commercial antiozonants or antiagers as preventives of ozone-cracking in oil-extended butadiene/styrene rubber. Their effects were studied on vulcanizates under varying static stress and with ozone concentrations ranging from 400 p.p.hm to 12 p.p.hm. and parallel weathering tests were conducted. Relations, on the whole, proved to be similar to those for natural rubber and non-extended butadiene/styrene rubber; here, too, products of the class of p-phenylene diamine provided excellent protection. Accelerated tests in the ozone chamber gave only a rough reproduction of the relation in the weathering tests. The induction period (time before the first cracks appear) and initial rate of crack formation proved useful in identifying antiozonants. Apparatus was devised for producing and regulating supplies of ozone from 6 to 400 p.p.hm. with which, too, concentrations could be kept constant for 24 hours or more; it operates on the known principle of automatic KI titration with $Na_2S_2O_3$.

Aging Behavior of Butyl Vulcanizates. D. C. Edwards, Polymer Corp., Ltd., Sarnia, Ont., Canada.

By means of network density measurements, it is shown that the resistance of sulfur or quinoid cured butyl rubber to degradation on aging in air increases rapidly with increasing polymer unsaturation. This is attributed to an increase in the rate of oxidative cross-linking relative to the rate of scission. Resin-cured vulcanizates do not show this dependence, and it is postulated that the resin functions as an antioxidant as well as a cross-linking agent.

The vulcanizates are almost completely stable in water at 177° C., showing that hydrolytic scission does not occur and that thermal degradation is negligible at this temperature. Simultaneous exposure to air and water results in a rapid degradation at the surface. Data are shown for various resin curing systems to illustrate the influence of non-polymer ingredients on the air aging, water absorption, and surface degradation of these vulcanizates.

Oxidation of Unsaturated Elastomers. E. M. Bevilacqua, United States Rubber Co., Wayne, N. J.

A characteristic group of low molecular weight compounds is evolved during the reaction of rubber with oxygen. For natural rubber this group, which includes levulinaldehyde, acetaldehyde, and acetic and formic acids, has been shown to be a concomitant of the chain scission process. Members of the group can be determined quantitatively by simple methods. Thus, there is a convenient analytical tool with which to detect main chain fracture during oxidation of vulcanized rubber, a process not otherwise readily accessible to study. A series of vulcanizates of quite different characteristics has now been studied. It is found that main chain fracture accompanies oxidation in all types of vulcanizates, irrespective of the cross-linking agent or the cross-link structure. The presence or absence of fillers or of most conventional antioxidant materials has no effect on this fracture. Chain scission is not affected by oxygen pressure in the range from one-fifth atmosphere up to one atmosphere, although the rate of oxidation is affected by pressure changes for all vulcanizates, in keeping with the well-known sensitivity of rate of oxidation or raw rubber to oxygen pressure.

Since it is well established that changes in vulcanizing system do affect the changes on aging of many rubber products, introducing the occurrence of cross-linking reactions during oxidation as well as scission reactions, it is clear that these differ-

A view of one of the tables during the Phillips Petroleum International Corp. boat ride. Jan Willums, Phillips International, is in left foreground

ences must be attributed to the remnants of the vulcanizing system present in the fully vulcanized product rather than to changes in the mechanism of hydrocarbon oxidation.

In contrast to polyisoprenes, synthetic rubbers based on butadiene do undergo cross-linking during the hydrocarbon oxidation complicating the interpretation of oxidation mechanism. It has now been found possible to obtain reasonably reliable estimates of the relative rates of cross-linking and scission reactions during the oxidation of SBR and of the efficiency with which oxygen is used in these reactions. Use is made of the sol-gel relationships which have been successfully developed elsewhere during the study of radiation effects on high polymers.

The Mechanics of Ozone Cracking. M. Braden and A. N. Gent. British Rubber Producers. Welwyn Garden City.

Experimental measurements are described of the growth of a cut in a stretched rubber sheet under the action of an atmosphere containing ozone. A well-defined rate of crack growth is obtained, substantially independent of the applied tensile stress when this exceeds a critical value necessary for growth to occur at all. The rate of growth is found to be similar for a number of polymers and principally determined by the ozone concentration when the mobility of the polymer molecules is sufficiently high. When the molcular mobility is inadquate, crack growth is retarded.

The critical condition is found to be similar for all the polymers examined, and largely independent of the conditions of exposure; it appears to reflect an energy requirement for growth of about 60 ergs/cm^2 of newly formed surface.

The effect of the degree of vulcanization and the presence of additives, including antiozonants, on these two factors has also been examined. The dialkyl-p-phenylene-diamines are found to confer protection by raising the critical energy required for growth to occur, in contrast to other protective agents which affect only the rate of crack propagation.

Elastomers III and Testing II

The Effect of Piperidine on Rubber Solutions. A. Soininen, W. Bask, A.-L. Pehu-Lehtonen, Soumen Kumitehdas Osakeyhtiö, Helsinki, Finland.

The measuring of viscosity has been used as an indicator with which we have determined the amount of piperidine needed for the essential decrease in viscosity. The turning point in the viscosity curves of the crepe rubbers studied in 5% solutions equals 3×10^{-5} moles piperidine; this amount appears to be in a stoichiometric relation to the rubber being used. Because of this we have been led to the conclusion reached by Meyer, according to which rubber contains associating oxygenous groups. The strongly decreasing effect of piperidine on viscosity would thus be due to the fact that this amine destroys all the associate bonds formed by the oxygenous groups in the rubber molecules. Both the weak alcohol and ketobonds and the strong carboxyl associations are broken. It is very likely that rubber molecules associate with the aid of carboxyl groups, as carbonic acids in general, in which case they will form a rather stable dimeric compound with two hydrogen bridges.

Strongly dissociated basic piperidine is probably capable of destroying strong carboxyl association bonds and forming the corresponding salt. The viscosity of the solution is thus greatly decreased because the apparent average molecular weight of rubber is considerably reduced. The basic character of piperidine must also be involved in this, since salicylic acid, which is largely similar to piperidine as regards dissociation, does not affect the viscosity in the same way as this organic base. The effect of polar chloroform is broadly similar to that of salicylic acid.

It seems feasible to assume that mastication does not destroy the association bonds in rubber, since the turning point in the viscosity curve was almost the same although the solutions contained rubbers with different degrees of mastications.

Finally it was particularly interesting to observe that piperidine does not decrease the viscosity of synthetic *cis*-isoprene rubber solutions. In this respect the latter differ definitely from natural rubber.

Control of Variations in Supplies of SBR Synthetic Polymer. C. J. A. Heal, Dunlop Rubber Co., Ltd., Birmingham.

Our experience has shown that SBR polymers have two features which are prone to excessive variation.

(a) Cure Rate of LTP.

(b) Processability of OEP.

If these factors could be controlled a large proportion of the variation attributed to synthetic rubber would disappear, and there would be some hope of uniformity in synthetic rubber of the SBR type.

(a) Cure Rate of LTP

Polymer producers use a channel black/MBTS test recipe to control the vulcanizing properties of LTP 1500. This method, originated in 1941, when tire compounding was based on channel black and MBT/MBTS acceleration, is too insensitive and is unsuitable to control supplies of polymer to meet the requirements of present-day compounding techniques. The adoption of the HAF/CBS test procedure with its greater degree of discrimination gives a more reliable assessment of the vulcanizing characteristics of LTP 1500, resulting in greater uniformity of the properties of the finished product.

The use of polymer to the limits quoted for the described HAF/CBS method appreciably reduces the variation in the vulcanizing properties of factory mixed compounds and considerably helps production departments.

(b) Variations in the Processing Properties of Oil-Extended Polymers.

The use of oil-extended polymers of the 1710 and 1712 types in tread and sidewall compounds has led to considerable processing difficulties, due to extreme variation in the behavior of these compounds during mixing, extrusion, cover making, and molding. By segregating deliveries of polymers into lots according to date code it was soon apparent that much of this processing variability was due to variations in the polymer. Certain lots processed satisfactorily; whereas other lots gave compounds which showed the following adverse features and for future reference will be referred to as "poor processing polymers."

These "poor processing" polymers were found in deliveries not from one producer exclusively, but in consignments from various producers, so that this type of variation could not be attributed to any one particular source of manufacture. As these difficulties in processing have been experienced with both 1710 and 1712 polymers, the type of oil is not the significant factor in deciding processability. Therefore these variations must be due to some basic difference in the fundamental properties of the polymer hydrocarbon which are not being detected by the usual control tests.

Our investigations have shown that the processing properties of OEP are related to the plasticity/time curve as determined by the Mooney plastometer.

The Distribution of Foreign Matter in Off-Grade Rubbers and Its Significance to the Rubber Manufacturer. M. G. Peakman, Dunlop Rubber Co., Ltd., Birmingham.

The prices of natural rubbers are, generally speaking, scaled according to their relative qualities. It is in the interest of each rubber manufacturer, therefore, to insure that the grade of rubber used for any particular product is the lowest possible which will satisfy his own standards of quality.

Functionally, many of the lower grades of rubber are equal to their first-grade counterparts, and the major consideration likely to be involved in their wider use is the possible effect of their contained foreign matter upon the subsequent performance of the end-product. This could be of particu-

lar significance in relation to crack-growth in a product to be subjected to continuous flexing in the course of its normal service, e.g., the pneumatic tire.

An estimate has been made of the approximate distribution according to particle size of the foreign matter contained in sample blends of RMA 4, RMA 5, and EBC 3X.

It is possible to remove some of the foreign matter from the rubber by *straining* the latter through a woven-wire or pierced-metal screen fitted to the delivery end of a simple screw extruder. The size of the particles held back by such a screen is not a function of the aperture dimensions alone, but is conditioned by the gage of the wire used and the pressure developed in the head of the extruder.

The temperature to which the rubber becomes subjected during the straining operation is directly related to the rate at which the screen becomes choked, i.e., the use of a very fine screen or a very dirty rubber will be accompanied by relatively high processing temperatures. Prolonged exposure of the rubber to temperatures in excess of approximately 360° F. can have an adverse effect upon the fatigue resistance of the ensuing vulcanizates.

No evidence was found during the course of the experiments to suggest that the particles of foreign matter in the rubber become broken up or in any way reduced in size during the compounding operation or the subsequent extrusion of the rubber into tire treads. The ultimate distribution of the foreign matter in the vulcanized tread of a finished tire appears perfectly random. An estimate has therefore been made of the quantity of foreign matter likely to fall within an arbitrary zone at the base of the tread pattern where the initiation of any splitting is likely to occur. From the estimates obtained by scaling the depths of the zone according to the size of the particles under consideration, it appears unlikely that the presence of very small particles is, of itself, the major cause of tread cracking in a pneumatic tire. It is also considered unlikely that even the larger particles will start cracking in a component otherwise free from such tendency. They might, however, accelerate the development or growth of cracks in a component already prone to cracking.

Tensile Strength of Styrene-Butadiene Rubber Vulcanizates, Reliability, and Variations of Measurements. W. May, Delft, Netherlands.

It is often assumed that tensile strength of styrene/butadiene rubber vulcanizates is neither easily reproducible nor reliable. Findings in the literature and investigations at the Royal Shell Plastics Laboratory, Delft, indicate that this assumption is not justified. A method is described, based on the accurate evaluation of curves for results of measurements, by which the most probable values for tensile strength and its real level can be arrived at. The data for a typical tire tread compound are reported to demonstrate the degree of reproducibility obtainable.

Influence of the Thickness of Test Vulcanizates on the Tensile Strength Values Measured by the ASTM Standard Method. D. I. Nazeni, Bogor, Indonesia.

In practice it has been found that in this ASTM test, using the mold specified in ASTM D 15-59T, Methods of Sample Preparation for Physical Testing of Rubber Products, relatively thicker dumbbells give lower tensile strength values than thinner test pieces of the same compound. Under the circumstances and in view of the literature on the subject, this phenomenon is inexplicable. Hence it was investigated by statistical methods. The existence of the effect was confirmed, and it was also established that prolonging the plasticizing time decreases the effect of thickness on tensile strength, but that this step has no effect on filled compounds. Since the actual pressure on the mix during vulcanization is always uncertain and unknown when normal vulcanization molds are used, investigations were also conducted with a special mold using a constant pressure of 337 kg/cm^2. It was found that at constant vulcanization pressure the influence of thickness of dumbbells on tensile values disappears. It is concluded that during vulcanization the pressure on thin samples is higher than on the thick ones. The possible connection between this phenomenon and defects and their distribution in the mix is discussed.

Oscar & Associates, Inc.

J. S. Islinger

Aerospace Elastomers

Requirements for improved performance being placed on elastomeric materials are getting tougher year by year as faster and higher flying manned aircraft are being developed, and with the planning of manned earth orbiting and space exploring satellites it can be expected that even more rigorous requirements will be desired. So predicts J. S. Islinger, Armour Research Foundation, in his talk given before the Chicago Rubber Group, Furniture Club, Chicago, Ill., on November 18 and titled, "The Role of Elastomers in the Aerospace Age." About 190 members and guests attended the session, which also included a film of flights of the North American X-15 rocket research airplane.

Mr. Islinger said that during the last ten years the science of elastomer technology has kept pace with developments of other materials of construction. Elastomers with both high- and low-temperature serviceability combined with resistance to fluids and chemical resistance undreamed of five to ten years ago have now been produced. Today this combination of properties is considered essential for successful operation of aircraft and missiles.

The speaker discussed many of the specific applications for elastomers in flight applications including fuel binders, wire and cable insulations and coverings, sealants, gaskets, pressure suits, and inflated constructions. In a discussion of coatings for control of temperatures within the vehicle, it was stated that SBR and some silicones withstand the ultra-violet radiation, vacuum, and vacuum-thermal effects without undergoing volatilization or degradation. These are followed by natural rubber, "Viton," neoprene, and butyl in descending order to fair stability and polyurethane with poor stability.

The speaker noted that sealing was a major problem in space flight and discussed some of the needs of elastomers to meet this challenge. Factors involved in positive sealing include mechanical factors such as seal geometry, static and dynamic loads, the nature of the sealing applications itself, and the internal and external pressures which the seals are to withstand. The material factors include the physical properties, the gas permeability characteristics, the vacuum volatility, and the temperature and radiation resistance of the materials. A third factor is the sensitivity of the leak detection method utilized to detect and measure leakage past the seal.

These problems will certainly occupy much of the effort of elastomer technologists in the immediate future.

washington report

By JOHN F. KING

Rubber Industry Should Benefit Greatly from "Buy American" Order

The Eisenhower Administration, in its last days of power before President-Elect John F. Kennedy takes over the reins of the government, moved rapidly in December to reorient the foreign military and economic aid programs to a "Buy-American" philosophy. The net benefit to the American rubber industry, if Mr. Kennedy allows President Eisenhower's eleventh hour change in aid policy to stand, could easily run into tens of millions of dollars a year in additional sales.

It is difficult to pinpoint the exact dollar total of new procurement of rubber and other soft goods that would accrue to U. S. business as a result of the sweeping reversal of foreign aid policy ordered into effect by Mr. Eisenhower on November 17. (See RUBBER WORLD, December, p. 120.) This is because the far-flung and variegated programs operated by military and economic aid agencies do not readily lend themselves to a commodity breakdown. For example, audits of the Defense Department's purchases of soft goods abroad for use overseas—which were practically shut off on December 16—are not available.

$30 Million in New Sales

But information obtained from the International Cooperation Administration, which operates the economic aid side of the Mutual Security Program, indicates the bonanza to U. S. rubber industry could exceed $30 million in new sales in the current fiscal year. This is the amount which that agency alone would have purchased, almost in toto, from foreign suppliers had not the President's November 16 "Save-the-dollar" directive changed its plans.

The change in ICA plans came December 5 in an order from Secretary of State Christian Herter to ICA Chief James Riddleberger to halt purchases of goods with U. S. aid dollars in 18 industrial countries plus Hong Kong. The Herter order, implementing Mr. Eisenhower's November 16 general directive, reflected the Administration's determination to curb the outflow of dollars to dollar-rich nations. The substantial buildup of dollar holdings by these nations is being converted to gold, thus creating a heavy drain on U. S. stocks of the precious metal, and the Eisenhower Administration has no wish to add to their wealth—at this country's expense—by financing purchases from them with U. S. aid dollars.

By barring aid purchases in the 18 nations and Hong Kong, the State Department theoretically left open a loophole for ICA to continue some semblance of its old "offshore" procurement program. But department experts point out it is "not probable" that underdeveloped nations such as Jordan, Iceland, Ghana, or any other nation not mentioned in the prohibition would be in a position to supply the complicated products required in the economic aid program. The net effect of the order, therefore, is to tie aid spending to U. S. suppliers.

Shift to Be Gradual

What is involved in the ICA program is about $400 million in foreign aid funds programmed for spending abroad under the Mutual Security Program. But the State Department's order to ICA directed an "orderly cessation" of procurement in wealthy nations, so this, plus the need of aid-recipient nations to change their buying habits, is not expected to produce a net change in buying this year of more than $200 million. An indication of what this will mean to U. S. rubber product suppliers is seen in the fiscal 1960 spending breakdown of the International Cooperation Administration.

In that year, which ended June 30, ICA spent $867 million for procurement. About 58% of this total, or $507 million, was spent in other countries, and about $360 million in the U. S. Of the fiscal 1960 grand total, more than $32 million was spent on three main categories of rubber products—tires, tubes, repair materials, crude rubber and "allied gums," and miscellaneous material.

Of the $32 million spent on rubber products, U. S. suppliers received only 11% of the total, or about $3.6 million. Western European suppliers received nearly $18 million of the total, or 55%, and Far Eastern suppliers—Malaya, Japan, and Hong Kong, largely—got $9.9 million, for 30% of the total.

Further broken down by countries, the ICA data show that the biggest beneficiaries of ICA orders for rubber products were the United Kingdom, with $4.3 million; West Germany, $4.0 million; Japan, $3.7 million; France, $3.2 million; Italy, $2.4 million; Belgium, $1.5 million; and Hong Kong, $1 million. Broken down by categories of rubber products, the ICA data show that the bulk of the $32 million—$22.4 million—was spent on tires, tubes, and repair materials. In this subtotal, U. S. suppliers did a little better with $3.0 million aggregate for 13%. Europe again got the lion's share, with $17.3 million, or 77%. In the crude rubber and "allied gum" subtotal of $8.4 million, almost the full total, 97% went to Far Eastern suppliers. In the miscellaneous rubber product category, which totaled $1.6 million, U. S. suppliers filled orders for 37% of the subtotal, or nearly $600,000.

$1/4-Billion Spent on Rubber

By way of historical interest, ICA and its predecessor aid agencies have spent $18.7 billion on soft goods, consumer durables, and capital equipment since the U. S. foreign aid program began in 1948. Over a quarter billion dollars worth of this grand total—$252 million to be exact—was spent on the three categories of rubber products mentioned above.

Apart from what ICA is doing in the aid procurement field, Washington attention turned in late December to the Pentagon's implementation of the

President's November 16 directive with the military "Buy-American" program. The most dramatic aspect of the military services' activities in this field came immediately on the heels of the President's order, when 284,000 of the combined services' 484,000 dependents overseas were ordered home, and a sharp reduction in military spending abroad on goods and services for use by overseas military installations was ordered into effect.

This was followed up December 16 by the Defense Department directive to the services to buy only U. S. goods and services for use outside the U. S. unless they received foreign bids to supply their needs at prices 25% under competitive U. S. bids. The net effect of this policy action was to restore the statutory 25% preference for U. S. suppliers which was written into the 1933 "Buy American" Act. It also supersedes an October ruling (see RW, November, page 108) which orders a U. S. preference if the cost is not higher.

Pentagon spokesmen estimated that at least $65 million formerly programmed for expenditure abroad this fiscal year would be diverted to U. S. suppliers. The total diverted amounts to about half the U. S. military agencies planned to spend abroad this year on goods for use overseas.

Significantly, the Pentagon's foreign spending cutback includes orders to the military agencies to review research and development programs with a view to determining whether U. S. concerns and institutions might be qualified to undertake R & D programs which formerly or at present are contracted out to foreign firms. Also included in the new policy were orders to review all existing supply and service contracts with a view to cancelling those now held by foreign firms where "charges plus the cost of repurchase in the U. S. would be within the 25% cost differential (U. S. preference)."

Future Still in Question

The whole question of the Eisenhower "Save-the-dollar" directives in late December boiled down to this: Will the Kennedy Administration reaffirm the Eisenhower orders, which constitute a handsome 1960 Christmas gift to U. S. business, or will it overturn them when it moves into the Capital? Top spokesmen for the Kennedy Administration are keeping mum on the subject, but there is one factor in the situation which indicates the new President may affirm the Eisenhower orders:

The threat of continuation of the Eisenhower "Buy-American" policies may be a useful club with which to force other nations to contribute more to foreign aid and mutual defense programs, thus relieving the U. S. of this portion of the dollar drain and permitting relaxing purchase restrictions.

General Tire Gets OE-SBR Patent, Offers Licenses to All Producers

The General Tire & Rubber Co. on December 13 was officially awarded a United States patent for its high-Mooney oil-extended rubber composition and promptly filed suit against Goodyear Tire & Rubber Co. and United States Rubber Co. for infringement of the patent.

In addition to filing the two infringement suits in Federal District Court in Cleveland the same day that the U. S. Patent Office finalized its patent (No. 2,964,083), General President M. G. O'Neil immediately offered licenses under the patent to the entire rubber industry.

"Now that a patent has been granted to General Tire covering the oil-extended rubber," O'Neil said, "we expect to charge a reasonable royalty for a license to other companies who want to use our invention."

He estimated that in 1959, three-quarters of the 1.4 billion pounds of oil-extended rubber produced went into the manufacture of tire treads. General asserted in a formal statement that use of its patented invention for making tire treads "has been almost universal" in the U. S. tire industry.

Goodyear and U. S. Sued

In commenting on the infringement suits against Goodyear and U. S. Rubber, O'Neil stated they were filed largely for procedural considerations.

"Both companies named in our suits are producing tires with treads made from oil-extended synthetic rubber—involving the invention made by a General Tire research team as covered by the patent in suit."

O'Neil also said that the oil-extended rubber process has been estimated to constitute a saving to the motoring public in excess of $60 million a year in purchases of tires and other rubber products. He also estimated that "continued widespread use of it by the rubber industry will result in total savings to the public of hundreds of millions of dollars during the coming decade." The savings accrue by virtue of the fact that the process permits a greater number of tires to be made at lower cost which tires are capable of 18% longer wear, General asserts.

General has spent the last decade in a long drawn-out legal battle with the U. S. Patent Office for the right to patent the discovery of a team of General scientists that large amounts of oil added to tough, high-Mooney synthetic rubber would produce a highly desirable tread rubber. The company's efforts were capped with success last June when Federal District Judge Alexander Holtzoff ruled that General's discovery was new and entitled to patent protection. (See RW, July, page 101.) Holtzoff's ruling came in the wake of a Patent Office approval and subsequent reversal of a patent grant to General.

After a long period of legal indecision, the Justice Department, which had opposed General in the District Court fight, decided not to appeal the Holtzoff decision. Accordingly, the Patent Office on December 13 awarded General the oil-extended synthetic rubber patent.

Royalty Proposed: 3/8¢

According to a *Wall Street Journal* report, General Tire is said to be asking other tire manufacturers to pay a royalty of 3/8¢ a pound for oil-extended rubber used in making tire treads. An initial fee of $2,000 would be required for a license, and a minimum royalty of $2,000 per year would be specified. An escalator clause would peg the royalty to the price of synthetic rubber with a change in SBR price of 10% automatically changing the royalty.

It is estimated that royalties on the process could amount to $3.9 million annually if General Tire should succeed in licensing all other tire producers. The royalty would amount to about 4¢ per passenger-car tire.

Other rubber companies have refused to comment on the situation until they have had an opportunity to study the patent.

Equipment Purchases Quite High in 1960

The Commerce Department's Business & Defense Services Administration points out in its latest monthly industry report that despite the recession—which rubber companies by mid-summer clearly noticed by their slump in sales—the industry is increasing capital investment both at home and abroad.

After noting in its October report, made public in December, that sales of rubber products in July fell sharply to $480 million, the low point for 1959-1960, BDSA's Chemical & Rubber Division said new plant and equipment outlays by U. S. rubber concerns will jump 26% in 1960, from $190 million in 1959 to $240 million.

The report noted that industry expenditures for new investment have been rising steadily since the first quarter of 1959, with the exception of the normally low first quarter of 1960. The rise continued through the year despite the poor sales totals that began showing up by mid-summer, and the increase in manufacturers' inventories

(*Continued on page 90*)

industry news

Tire Companies, Led by Firestone, Slash Passenger Tire Prices $1-4

Firestone Tire & Rubber Co., Akron, O., slashed retail prices of passenger car tires $1 to $4 on December 1, and Goodyear Tire & Rubber Co., The General Tire & Rubber Co., and Seiberling Rubber Co. immediately followed suit. The other producers were expected to fall in line almost immediately.

The Firestone price cut was coupled with a new 12- to 30-month time-service guarantee against most common road hazards, 12 months for the third-line Champion to 30 months for the Butylaire and Premium Quality. This is in addition to the lifetime guarantee against defects in material and workmanship and the Firestone customer satisfaction guarantee.

Other companies indicated they would give a similar guarantee. Firestone said its time-service guarantee is the first by a major company in recent years. Small tire companies have had such a guarantee for some time. Seiberling, for example, gives a warranty for replacement of tires which fail because of cuts from glass or nails or from similar "normal" causes, giving such a guarantee for the life of the original tread without a specified limit of time or mileage.

According to the December issue of *Modern Tire Dealer*, the price cut will hurt the small tire companies, which have had rapidly declining profits due to low prices and a highly competitive marketing situation combined with high costs. Lower prices will also affect sale of retreads, *Modern Tire Dealer* pointed out.

The price cut was reportedly aimed at the discount houses, chain stores, and mail-order houses, which have been giving considerable competition to the more conventional tire outlets. An independent survey in 1960 showed that Sears Roebuck and Montgomery Ward ranked third and fourth, respectively, in passenger-tire sales, right behind Goodyear and Firestone.

According to *Modern Tire Dealer*, the cut leaves prices near the promotional levels that existed during the summer selling season. Prices to dealers will be at about the same level, or slightly lower than they were this summer.

Firestone noted as examples of the cuts that its tubeless first-line Firestone Nylon "500" is reduced from $24.45 to $22.95; the first-line Deluxe Champion (Tyrex) from $21.95 to $20.95; the second-line Safety Champion nylon from $21.45 to $18.95, and the third-line Champion nylon from $15.95 to $14.95. The second-line rayon tire is being dropped. Prices include customer trade-ins.

Following the action on passenger tires, Goodyear announced that, effective December 7, list prices of its larger truck tires, from 8.25 cross-section through 11.00 cross-section, would be cut approximately 7½%. The move was made to bring the company's published prices more in line with actual selling prices, Goodyear explained. Other companies are expected to match the cut, which will also squeeze the smaller producers.

The announced price cuts are expected to offset the expected decrease in manufacturer costs resulting from recent drops in the price of natural rubber, which has fallen from 47¢ a pound at the end of June to about 28¢ at the present time.

Richard S. Walker

Walker Named Editor

Richard S. Walker has been named editor of RUBBER WORLD. In announcing the appointment, John W. Hartman, president, Bill Brothers Publishing Corp., said that the change was made to continue the editorial expansion and development of the magazine. Walker, who served as executive editor for the past 14 months with increasing line authority, will now assume direct responsibility for the editorial activities of RUBBER WORLD.

Robert G. Seaman, editor since 1945, becomes senior editor. This position will allow him to intensify his industrial contacts, engage in long-range planning and research projects, and serve as a consultant to the editor.

Walker, a member of the fifth generation of his family to be actively engaged in the rubber industry since his great-great grandfather entered the field in the mid-1800's, started his own career with the H. O. Canfield Co., following his graduation from Lehigh University in 1950. In 1955 he was transferred from his position as assistant to the chief chemist at the Bridgeport, Conn., Canfield plant to chief chemist at the newly established subsidiary at Clifton Forge, Va. In 1958 the new editor joined the Goodyear Tire & Rubber Co. chemical division as senior sales engineer for nitrile rubber. He joined RW in 1959 as technical editor.

Seaman, who joined the RW staff as technical editor in 1942, had previously been employed by United States Rubber Co. in Passaic, N. J., and Providence, R. I., and is a graduate of Cornell University.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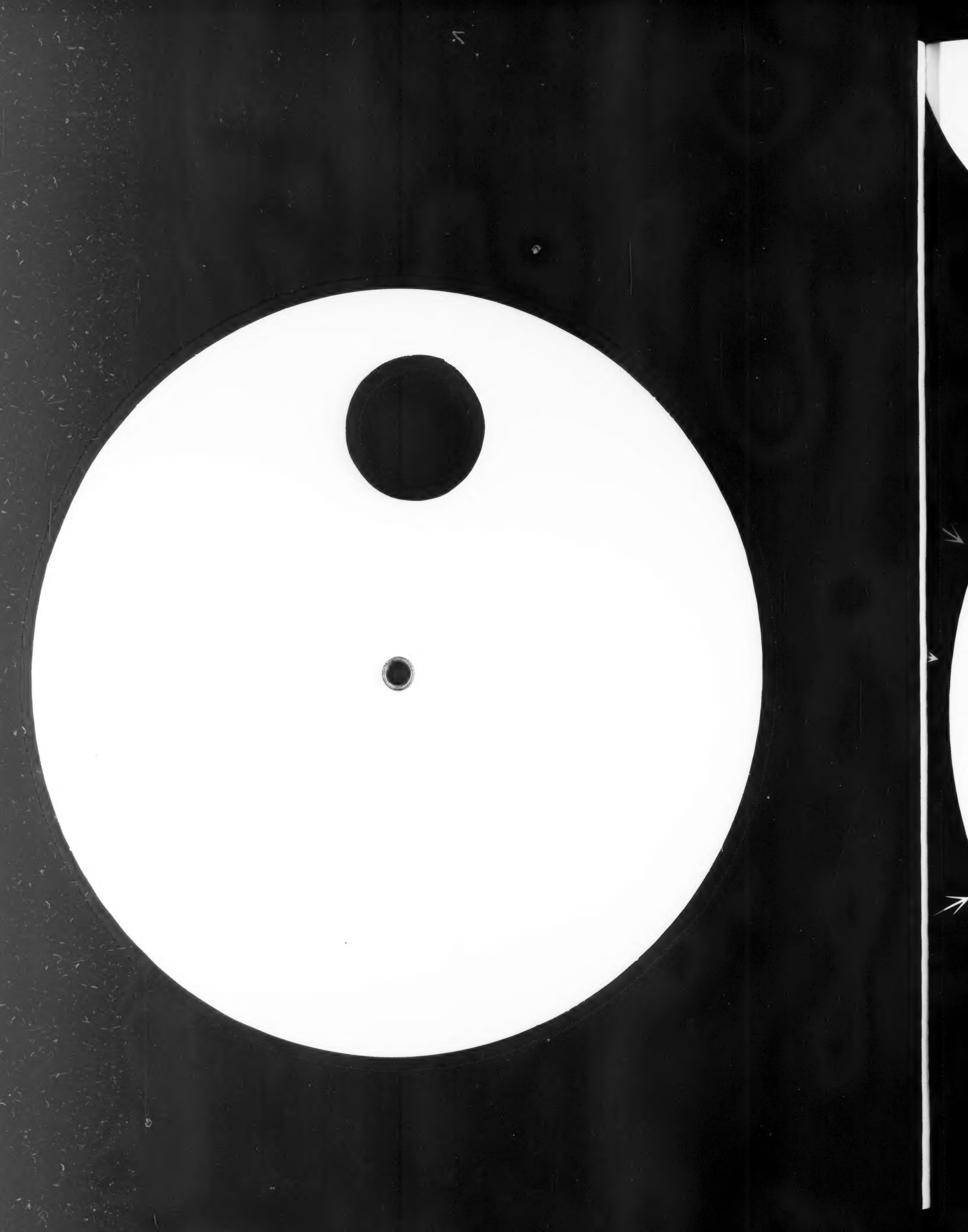
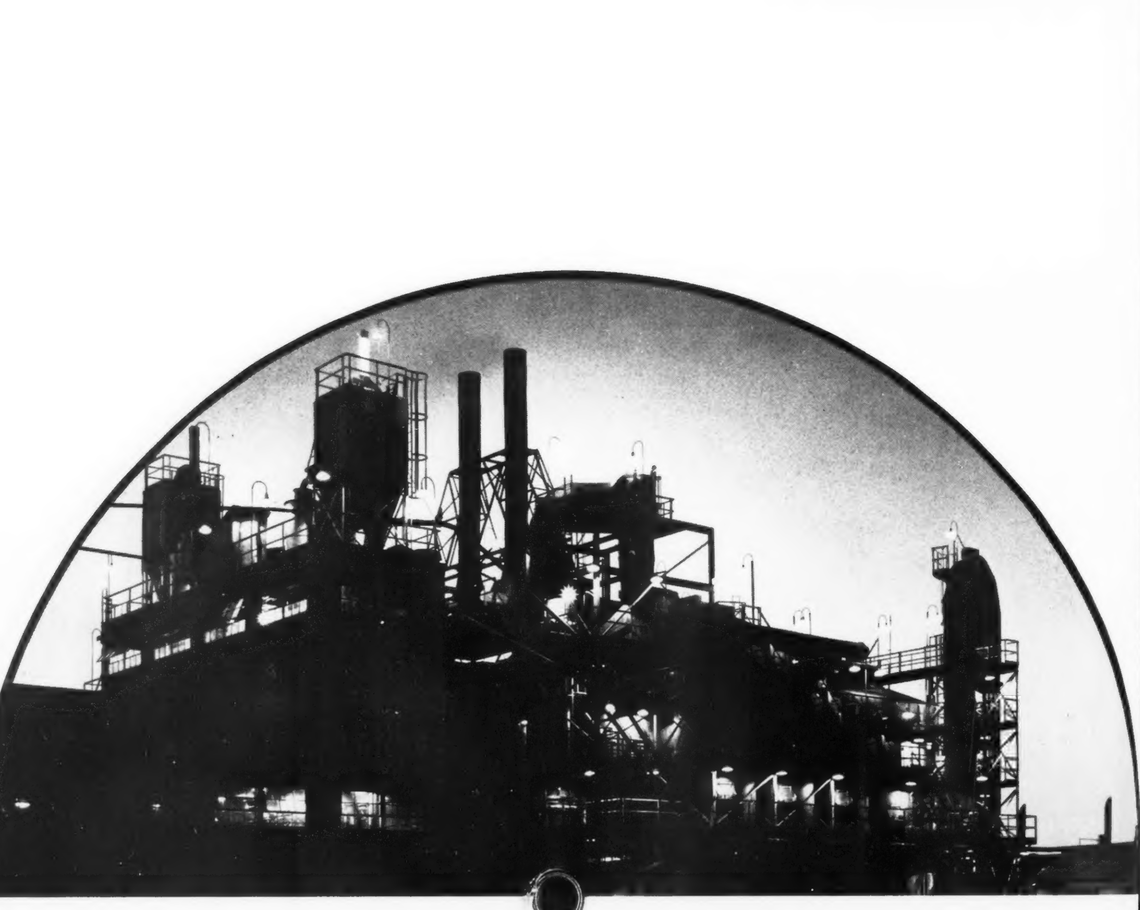




Printed in U.S.A. January 1961

Stauffer, Hewitt Join To Make Foam Products

Stauffer Chemical Co., New York, N. Y., and Hewitt-Robins, Inc., Stamford, Conn., have formed a new jointly owned company, Stauffer-Hewitt, Inc., which will manufacture and sell polyurethane foam materials. Stauffer will own two-thirds of the new company which will buy the assets of the Hewitt-Robins urethane foam division, including the trade name, "Restfoam." The plant and headquarters are at Franklin, N. J.

Hewitt-Robins began development work on urethane foams four years ago. It is said to be the only former major producer of natural rubber latex cushioning which has changed to the urethane material. Stauffer will now participate in management and will take over any additional financing of the joint venture.

Shively Retires After 45 Years at Goodyear

Walter E. Shively, Goodyear Tire & Rubber Co.'s manager of tire engineering development since 1930, has retired after 45 years with the Akron, O., company.

The "dean of tire engineering" joined Goodyear after his graduation from Webb Institute of Marine & Naval Architecture. He became fascinated with the tire industry, and what he had intended to be only a summer job as a draftsman developed into a career. One year after he joined the company he was assigned to design the first pneumatic truck tire.

Lowering the air pressure in tires was one of the ideas Mr. Shively kept encouraging. Today's tires carrying only about 20 pounds of air pressure clearly bear out his theory when one remembers the 65-pound-pressure tires prevailing when he entered the field.

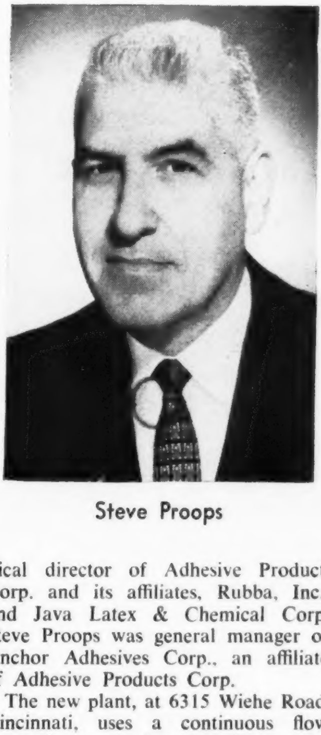
Mr. Shively plans to spend his time at his home in Akron and at his nearby summer home at Turkeyfoot Lake. He will continue his lifelong interest in the Explorer Scouts.

Form Adhesives Firm

A new adhesives firm, Imperial Adhesives, Inc., has opened its first plant, in Cincinnati, O., and is now producing natural rubber, reclaim, neoprene, nitrile, acrylic, vinyl latex and solvent adhesives. The company will also produce hot melts, polyester and epoxy compounds, plus customer emulsions and dispersions for the trade.

Imperial Adhesives is headed by two men experienced in the field. Jerry Conrad, president, was formerly technical director of Adhesive Products Corp. and its affiliates, Rubba, Inc., and Java Latex & Chemical Corp. Steve Proops was general manager of Anchor Adhesives Corp., an affiliate of Adhesive Products Corp.

Jerry Conrad



Steve Proops

The new plant, at 6315 Wiehe Road, Cincinnati, uses a continuous flow processing method and uniform temperatures in the latex tanks to produce product uniformity. The plant has its own railroad siding and tank farm with underground storage facilities for 150,000 gallons of latex and solvents. Two laboratories are equipped for tests of pull, discoloration, flex, aging, and abrasion on raw materials or finished product.

The company also plans to use automatic packaging methods which include use of new ICC approved lightweight shipping containers designed to save storage space and shipping costs and to insure against deterioration during long periods of storage.

Chemstrand Develops Improved Tire Yarn

A new nylon tire yarn, claimed to have 100% better fatigue resistance than present nylon yarns, has been developed by Chemstrand Corp., New York, N. Y.

The new nylon, Type FRN, is now available in 840 and 1680 deniers, the two yarns which are used for nylon tire cord.

The price will be the same as for Chemstrand's Type RHB tire cord yarn.

Type FRN is a Nylon 66 type, with tensile strength, heat resistance, adhesion, and resilience about the same as in Type RHB.

The increase in fatigue resistance is obtained by modifications in polymer, processing, and finishes, Chemstrand further declared, but declined to specify the modifications.

Chemstrand said use of FRN nylon will make possible more retreads of a single tire, will increase the percentages of tires suitable for retreads, and will cut blowouts and flats.

E. I. du Pont de Nemours & Co., Inc., has also indicated that it has developed an improved nylon tire yarn, but has declined to give specifics.

Improvements in tire yarn are expected to give the nylon manufacturers another weapon in their continuing battle to take over the market for original-equipment passenger-car tires. They have already made considerable inroads into the truck tire and replacement passenger tire market.

Chemstrand suggested that the new yarn would be particularly useful in "double air chamber" tires now standard equipment on many station wagons. When the air escapes and the car is traveling on the tire within a tire, the tire is undergoing considerable stress, and the additional fatigue resistance of FRN nylon will prove vital.

Chemstrand also said that the new yarn will have considerable use in trucking, where tires are often overloaded, with abnormal heat generated by the overflexing of the cord body of the tire. The result is much greater fatigue than normal. The same resistance to fatigue failure would apply to aircraft carrying heavy loads, Chemstrand added.

Indoor wheel tests conducted by the company show FRN yarn with a residual strength of 27.6 after 4,153 miles, compared with 27.0 after 1,377 miles for comparable yarns; 27.8 at 3,833 miles, compared with 30.0 at 2,257; 28.7 at 4,167, compared with 28.1 at 1,502; and 26.9 at 4,241, compared with 26.7 at 3,057.

Fleet test results showed a residual strength of 22.1 after 18,731 miles, against 26.2 at 10,023 for comparable yarns, and separation resistance of 28 hours to failure, contrasted with 18 hours for comparable yarns.

Cooke Color Has Plane For Trouble Shooting

Cooke Color & Chemical Co., Hackettstown, N. J., has found that having its own private plane is an almost indispensable tool in helping customers to meet their color matching problems.

When a customer has a color problem, he needs an answer in a hurry. The private plane can provide this service faster than either a car or a commercial airline, Cooke officials note. In one recent case a Midwest firm had trouble getting the color it wanted. He called Cooke at about 10 a.m. and was told to meet the Cooke plane at his local airport. The plane left from company headquarters, picked up the official of the customer firm and his samples, and flew him down to Hackettstown to work on the problem. By afternoon he was back at his own plant, and the new color was in production.

Comparison times between car and plane are, in one case, 15 mintues to Rome, N. Y., by plane *versus* six hours by car. In another case, it takes the Cooke plane a hour to fly to Buffalo, N. Y. It takes an hour and 20 minutes just to drive to Newark Airport in order to catch a plane.

Cooke officials believe that having their own plane has other advantages. Many cities have only one or two flights a day of commercial airlines. Many more have no flights at all, and many plants are not located near any city, but do have a private airstrip somewhere nearby.

Fred Cooke, president of the company, points out that the amount of colors sold on a trouble shooting call is small, not nearly enough to pay the cost of the trip. But, he said, a firm which has a problem and can get a fast answer from Cooke is likely to switch its business to Cooke. Along the same line, although Cooke makes regular service calls on its own customers, its plane is available for any emergency service.

The company will either fly a man up to a firm's plant to do blending on the spot if facilities are available, or fly a representative down to the Cooke plant to get the job done.

Besides handling hurry calls anywhere from New England to the Gulf Coast of Texas, and the East Coast to Kansas City, Cooke uses its plane for selling purposes. Pilot Edwin Zabowski, a salesman and former laboratory chemist, covers the New England area by car and the southern states south of the Carolinas by plane. In addition he is available to pilot other members of the firm on selling and service trips elsewhere. One of the next trips, purely as an experiment, may be to Los Angeles.

The company feels that besides providing prompt service, the plane saves many manhours which would otherwise be wasted on the road.

Its plane, a single-engined Cessna, has a cruising speed of 150 miles an hour and logs 500 to 600 hours in the air per year. With that amount of use, the company estimates, traveling by private plane is little more expensive, if at all, than traveling by car.

Dye Latex Backings

Latex backings for fabrics can now be dyed in the same operation with the fabrics through use of color acceptors developed by Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

According to Naugatuck Chemical, which has applied for a patent on the process, the "color acceptors" are blended into the latex compound. In effect, the dispersed chemicals take the dye, either acetate or direct dye, thus coloring the compound.

The backings are applied as the fabric comes from the loom. The rubber coating is then cured either by air drying or in curing ovens. Following this step, the fabrics and backing are run through the dyeing process. Conventional latex backings will not take dye and remain white or off-color yellow. In loosely woven fabrics the backing is visible through the fabric surface, and even in tightly woven materials the lack of color is a problem, the company says.

Some latex backings have a pigment blended into the compound before curing, but this is difficult since separate batches must be mixed for each color run of the fabric.

The dyeable latex compounds are already being used by several textile manufacturers, Naugatuck reports.

Rubber Firms Offered Long Equipment Leases

Rubber and rubber products companies with a tangible net worth of \$1 million or more are offered 6-12-year leases on equipment under a plan announced by Nationwide Leasing Co., Chicago, Ill.

The leases would apply on \$25,000 or more of equipment. In addition to having a tangible net worth of at least \$1 million, firms would be required to show a five-year record of profitable operations. Equipment desired must have a depreciable life greater than the term of the lease.

Robert Sheridan, president of Nationwide, said that the plan is the first for long-term leases. Up to now leases have normally ranged from 3-5 years, with an average length of 3.7 years.

Sheridan further declared that the plan will free companies from the need of tapping long-term debt or equity funds for the amounts required in acquiring equipment. The absence of such a plan has slowed plans of companies to modernize plants and equipment, he explained.

Polybutadiene Plant Opened by Phillips

Phillips Chemical Co. has gone on stream with the country's first commercial-scale production of polybutadiene at its new Borger, Tex., plant.

The plant has announced capacity of 25,000 tons. The company was scheduled to announce a price for polybutadiene in commercial quantities early in

(Continued on page 90)

Robert S. Knerr

Edwin Zabowski, salesman for Cooke Color & Chemical Co. and pilot of its private plane, alights on a sales call after flying from company headquarters in Hackettstown, N. J.

news briefs

KENRICH PETROCHEMICALS, INC., Maspeth, N. Y., has concluded a merger agreement with Laribee Wire & Equipment Corp., Camden, N. Y. Kenrich manufactures petroleum resins used in wire insulations, and Laribee manufactures copper wire and cable. Kenrich had previously announced plans to manufacture wire insulating compounds.

BJORKSTEN RESEARCH LABORATORIES, Madison, Wis., and Houston, Tex., has extended laboratory services to include custom organic syntheses and has installed reaction and still equipment of up to 30 gallons' capacity for syntheses and polymerizations.

AMOCO CHEMICALS CORP. will build new facilities at Texas City, Tex., for manufacture of Panarez hydrocarbon resins. Construction of the plant is scheduled for completion this year. The resins are used in the rubber goods, surface coatings, and floor tile industries.

MISSOURI SOLVENTS & CHEMICALS CO., St. Louis, Mo., has been appointed distributor for two major chemical product lines by Antara Chemicals, a division of General Aniline & Film Corp., New York, N. Y.—Igepal Surfactants and Cheelox chelating and sequestering agents. The company will distribute Igepal CO- and CA- Series, Surfactants, the most significant and widely used non-ionic surface active agents produced by Antara. They are used by producers of detergents, emulsifiers, wetting agents, and foaming agents in formulations of great numbers and quantities of consumer and industrial products. The Cheelox sequestering agents are employed in the textile, leather, paper, and many other industries, as well as in the formulation of agricultural chemicals.

O'SULLIVAN RUBBER CORP. has acquired all the outstanding stock of Gulfstream Plastics, Inc., Hialeah, Fla., which is engaged in the manufacture of injection molded products. This acquisition will expand the scope of O'Sullivan's activity in the plastics field.

G-63, a new aerosol spray for burns, is said to eliminate the need of bandages to speed healing processes as well as provide relief from pain. Distributed by General Scientific Equipment Co., Philadelphia, Pa., it is designed to be included in industrial safety kits

UNITED STATES RUBBER CO., New York, N. Y., has signed a technical service agreement with Rumianca S.p.A., Torino, Italy, for production of poly(vinyl chloride) resins at a plant to be built by Rumianca at Pieve Vergonte, Italy. The plant, to cost about $3 million, will have a capacity of 10,000 metric tons and is scheduled for completion in 1962. The agreement will include patent licenses, technical information, and engineering services.

BECKMAN INSTRUMENTS, INC., scientific and process instruments division, has moved its Buffalo regional sales office to larger quarters at 2451 Wehrle Drive. The office was formerly at 3053 Main St.

STAUFFER CHEMICAL CO. has appointed R. E. Carroll, Inc., Trenton, N. J., distributor for industrial and rubbermakers' sulfurs for New Jersey and the Greater Philadelphia area.

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La., has appointed B. E. Dougherty Co., with offices in Los Angeles and San Francisco, Calif., its exclusive West Coast sales representative, covering the states of California, Oregon, Washington, New Mexico, Nevada, Utah, Arizona, Wyoming, Montana, and Idaho.

UNITED STATES RUBBER CO., New York, N. Y., has moved its New York district sales office to 97 Bayard St., New Brunswick, N. J.

DOW CHEMICAL CO., Midland, Mich., has announced increases on Bisphenol A and Bisphenol 44, used as antioxidants and color stabilizers in the rubber industry and as intermediates in the manufacture of epoxy resins. Carload prices are up 1¢ to 30½¢ a pound for Bisphenol A and 33½¢ a pound for Bisphenol 44, and less than carload prices up 1½¢ a pound.

ARMSTRONG RUBBER CO., West Haven, Conn., is scheduled to start construction this month on a $25-million tire plant in Hanford, Calif. The plant is designed to have a capacity of 10,000 tires a day.

NAUGATUCK CHEMICAL DIVISION, United States Rubber Co., moved its New York and Philadelphia district sales offices to 97 Bayard St., New Brunswick, N. J.

ENJAY CHEMICAL CO., a division of Humble Oil & Refining Co., New York, N. Y., is now producing Enjay Butyl HT 10-66 (formerly MD-551), an elastomeric isobutylene-isoprene copolymer containing reactive chlorine. The new polymer can be cross-linked by a variety of conventional and novel vulcanizing techniques, using either the carbon-to-carbon double bonds or the reactive chlorine, or both. Vulcanization of HT 10-66 is usually more rapid than with unhalogenated butyl polymers; vulcanizates show the same inertness to environmental attack characteristic of butyl rubber. Stable cures make HT 10-66 especially suitable for service at high temperatures.

news about people

Mel Sutter Studio

C. J. Harwick

Fabian Bachrach

J. H. FitzGerald

C. J. Harwick, Jr., is now general sales manager of Harwick Standard Chemical Co., Akron, O., after having worked as a technical sales representative and assistant sales manager. **J. H. FitzGerald,** appointed manager of the Boston, Mass., operations, has been a technical sales representative in the area for the past ten years. **J. L. Weaver,** now manager of the Trenton, N. J., area, recently held the post of sales representative in that district.

William Stoker, Jr., has been assigned to a special project for the Hunter-Bristol division, Thiokol Chemical Corp., at Bristol, Pa. He will assist in developing markets for concrete coatings and adhesives based on Thiokol liquid polymers and epoxy compounds. Previously he was executive vice president of Yardville Supply Co.

Earl P. Hanson, formerly regional representative for both the Heyden Chemical and the Nuodex Products divisions of Heyden Newport Chemical Corp., has been promoted to district manager of Heyden Chemical and will handle 11 western states from the offices in Los Angeles and San Francisco, Calif.

Alberto Malatesta has been appointed a research group leader to the central research laboratories, The Borden Chemical Co., New York, N. Y., and will concentrate on polymer research. **Anton Jurecic** is now a research chemist for the company and will be chiefly concerned with polymeric latices.

Robert F. Shreve has been named head of the research and development department, Spencer Products Co., Ridgewood, N. J. A program is now under way to develop new products for the rubber and plastics industries.

J. L. Weaver

H. Heintzelman

H. C. (Skip) Heintzelman has been promoted to sales manager, industrial rubber products division, Cooper Tire & Rubber Co., Findlay, O. Before this appointment he served as assistant sales manager, special products.

William Weems has been named manager, special-purpose tire sales, for The General Tire & Rubber Co., Akron, O. **Frank Roch** replaces Weems as assistant manager, truck tire sales; while **Roy Simpson** becomes regional manager, special-purpose tire sales, of the Akron, Boston, Mass., New York, N. Y., Philadelphia, Pa., and Pittsburgh, Pa., divisions.

Rudolph Cubicciotti moves up to become administrative vice president of Witco Chemical Co., Inc., New York, N. Y., and will direct the planning and coordination of all activities directly related to future corporate growth for all Witco divisions. Before this promotion he was vice president of Sonneborn Chemical & Refining Corp., a wholly owned Witco subsidiary.

Frederick W. Moyer, assistant treasurer of The B. F. Goodrich Co., Akron, O., has been elected treasurer to succeed **E. A. Stevens,** who has chosen to retire for health reasons.

Haviland

R. F. Shreve

Esther Flohr Studio

J. J. McCarthy

James J. McCarthy now supervises sales and technical service for the new \$1¼-million U. S. Rubber Reclaiming Co. plant at Vicksburg, Miss., which went into production last November. Until this new appointment, McCarthy handled company sales in the midwestern and southeastern states.

Bryce I. MacDonald, Jr., becomes manager of manufacturing engineering, silicone products department, General Electric Co., Waterford, N. Y., and holds combined responsibility for manufacturing engineering and facilities engineering at the plant.

Fred P. Tarr has joined Dewey & Almy Chemical Division, W. R. Grace & Co., Cambridge, Mass., as a development engineer in the process development department of the organic chemicals division. He will work on design of equipment and plants for latices, emulsions, and resins.

Edgar E. Wrege has been appointed administrative assistant to **Herschel H. Cudd,** president of AviSun Corp., Marcus Hook, Pa. Dr. Wrege was formerly operations manager of the special products department, Avisco film division, American Viscose Corp.

A. Campbell, Jr., steps up into the position of manager of sales and marketing services for the Thermoid Division, H. K. Porter Co., Inc. He will head Thermoid's new sales and marketing services department at the division sales office in Trenton, N. J.

D. J. Eagan J. LeMay

Daniel J. Eagan occupies the new position of eastern district sales manager for The Firestone Synthetic Rubber & Latex Co. and will work out of Fall River, Mass. He was eastern district sales representative for natural and synthetic latices and dry synthetic rubber since 1955.

Edward L. Byan steps into the Minneapolis district sales manager spot for B. F. Goodrich Industrial Products Co. and will headquarter in the district office in Minneapolis, Minn. Since 1949 he was responsible for BFG's industrial rubber product sales in Virginia.

Frank A. Duffy this month assumed new duties as assistant to the president for operations at The General Tire & Rubber Co., Akron, O. He was president of Duffy General Tire Co., Atlanta, Ga.

Charles F. Ferraro, recently named supervisor of the polymer evaluation section of the organic and polymer department at the Food Machinery & Chemical Corp. research and development center, Princeton, N. J., is responsible for all work pertaining to measuring physical properties of polymers and plastic materials.

Ricardo Pagan heads the new export sales department for Ace Rubber Products, Inc., Akron, O., as director of foreign sales. Before this assignment he handled Ace's export sales for American Rubber Export Co., manufacturers' representative.

Irwin J. Schaffner has advanced to senior research scientist at the United States Rubber Co. research center at Wayne, N. J. Dr. Schaffner has been concerned with compounding research on natural and synthetic rubbers, especially those used in tires.

James S. Reid, Jr., now executive vice president of The Standard Products Co., Cleveland, O., served for the past two years as manager of the West Coast division at Fullerton, Calif., and is also a director of the company.

John LeMay, in the newly created position of manager of industry development for Richardson Scale Co., Clifton, N. J., will coordinate sales activities within industries served by the company and will supervise planned marketing for both custom and standard products.

Richard V. Thomas, vice president, has succeeded **E. E. Long** as vice president and general manager of Goodyear International Corp. Veteran of nearly 44 years' service and vice president since 1954, Long is retiring at his own request for reasons of health. He will serve in a consulting capacity until his retirement date, April 2, 1961. **William E. Forster,** production manager for the company's Western Hemisphere region, will replace Thomas as director of international manufacturing.

Joseph P. Bowen is now a representative for Parker Seal Co. in the Minnesota and Wisconsin area. He will work out of Milwaukee, Wis.

Leonard R. Fertig and **Raymond J. Mucci** have been appointed assistants to the president of United States Rubber Co., New York, N. Y. Fertig will coordinate management engineering activities and cost reduction programs; while Mucci handles administrative functions of the president's office and special assignments.

Roy G. Volkman has been made development manager for the mechanical goods division, United States Rubber Co., and will center his activities at Passaic, N. J. Since last January he served as general superintendent of production of synthetic fibers at the Providence, R. I., plant.

Raymond G. Noel has been named western district sales manager for Firestone Industrial Products Co., Akron, O. He formerly served as sales representative in Minneapolis, Minn.; Chicago, Ill.; and Des Moines, Iowa.

John N. Codrea is now in Teheran, Iran, as plant manager of B. F. Goodrich Iran, S.A., a newly organized subsidiary. Codrea will be in charge of production of the Iranian tire and tube plant scheduled for completion early this year.

Steven Manning has resigned as director of operations for Tyrex, Inc., New York, N. Y., to open his own marketing consulting firm.

W. A. Dimler, Jr., now serves as sales development engineer on the polychemical staff of Texas Butadiene & Chemical Corp., New York, N. Y.

R. V. Thomas J. D. Mahoney

J. D. Mahoney has been elected president of Mobay Chemical Co., Pittsburgh, Pa. He formerly was the company's director of marketing.

Peter J. O'Reilly has been added to the product development department of the Harchem Division of Wallace & Tiernan, Inc., Belleville, N. J. O'Reilly was formerly with Roger Williams Technical & Economic Services. **Donald Wild,** formerly with Chemical Rubber Co., has joined Harchem's field sales staff and has been assigned to the Midwest area.

John W. Hawley has been named chief products engineer, thermoplastics, of the molded products division, Stauffer Chemical Co., Los Angeles, Calif. In his new position he will be responsible for coordinating new product development, providing technical assistance to sales, and engineering assistance to the thermoplastics fabrication departments.

Elwood W. Phares has been promoted to the position of vice president in charge of sales of Cary Chemicals, Inc., East Brunswick and Flemington, N. J., producer of PVC resins and PVC-VA compounds. Formerly he was with Lederle Division of American Cyanamid in New York, N. Y.

M. A. Wilson has been appointed manager of tire engineering for The Goodyear Tire & Rubber Co., Akron, O. He succeeds **W. E. Shively,** who retired recently after 45 years with the company.

C. Robert Creamer, vice president and general manager of the plastics division of O'Sullivan Rubber Corp., Winchester, Va., has been named president of Gulfstream Plastics, Inc., Hialeah, Fla., a newly acquired subsidiary.

M. L. Jeter has been appointed administrative assistant to **W. T. Hall,** president of The C. P. Hall Co., Akron, O. Jeter was associated with The Firestone Tire & Rubber Co. purchasing department for 12 years.

Archie J. Smith has been named by Stewart Bolling & Co., Inc., Cleveland, O., to establish West Coast headquarters at 22270 Cavalier St., Woodland Hills, Calif. He will be responsible for both sales and service.

Gilman S. Hooper becomes director of research and development of the fiber development department of Hercules Powder Co., after having resigned as vice president in charge of research, Industrial Rayon Corp. Hercules recently acquired Industrial Rayon's Covington, Va., facilities and will convert the nylon plant to manufacture polypropylene fibers. Dr. Hooper was in charge of the polypropylene fiber research program for Industrial Rayon before the facilities were sold.

James F. Donnelly, formerly manager of Bridgeport Brass Co.'s tire valve division at Bridgeport, Conn., has been named general manager of the company's new plant under construction in Lisburn, Northern Ireland.

S. J. Spitz, Jr., succeeds **E. F. Sisson** as president of Newport Industries Division, Heyden Newport Chemical Corp., New York, N. Y. Spitz was executive vice president for the past year. Sisson has been with the company for 32 years. **Harold E. Rose**, formerly vice president in charge of production, takes over Spitz's executive vice presidency.

R. Edward Christner, personnel administrator of The B. F. Goodrich Co.'s overseas staff since February, has been named manager of employe relations for B. F. Goodrich do Brasil S.A., a subsidiary in Sao Paulo, Brazil.

Don W. Sullivan is now central division sales manager for Firestone Industrial Products Co., Akron, O. With Firestone since 1955, he was sales representative in Wisconsin for Industrial Products.

Phillips Plant

(Continued from page 86)

January. Price of the experimental product was 35¢.

At about the same time the Borger, Tex., plant went on stream, just before Christmas, United States Rubber Co., New York, N. Y., announced that it will produce truck tires utilizing a blend of polybutadiene and natural rubber as soon as shipments from Phillips permit.

A spokesman for U. S. Rubber said the rate of production will depend on the amount of polybutadiene the company can buy from Phillips.

Firestone Tire & Rubber Co. is due to go on stream with its first polybutadiene plant, at Orange, Tex., in January or February. Production is scheduled to be 30,000 tons. Goodyear Tire & Rubber Co. and Goodrich-Gulf Chemicals, Inc., will be ready for production probably by this summer, with another 40,000 to 50,000 tons between them. That would mean a production of 100,000 tons by late this year, or enough, using it in 50-50 blends with natural rubber, to supply a large share of the country's annual truck tire production, which was expected to run between 14 and 15 million tires in 1960.

This is a package developed by Seiberling Rubber Co., Akron, O., to eliminate "squeeze-out" when tread rubber is being shipped. The "Suspenda-Pak" container has a spindle around which the rubber is rolled so that it does not rest on its own weight. By preventing flat-spotting and loss of gage, this package cuts waste. Seiberling is using the box for its entire camelback line at no cost to retreaders.

Goodyear, Union Agree On Modernization Plan

Goodyear Tire & Rubber Co. has reached an agreement with Local 2 of the United Rubber Workers that will allow it to go ahead with a multimillion dollar modernization program at Plant 2 in Akron, O., the company and union jointly announced.

The agreement followed four weeks of negotiations and a series of meetings with groups of Plant 2 employes last October at which W. H. Rudder, manager of domestic tire production, put a question flatly to employes:

"If Goodyear management is willing to spend millions to modernize Plant 2, are you, the employes, willing to accept the responsibility of operating the equipment as it would be operated in another location?"

The negotiations following were on the piece-work rate for recently installed tire machines, designed and built at Goodyear and incorporating the company's latest techniques in tire building. Agreement on the piece-work rates, for a specified number of tires to be produced in a given length of time, demonstrates that both the company and the union are confident production output will be satisfactory, company and union representatives said.

The company said no substantial change in the Plant 2 work force is contemplated, but that it would not be possible to forecast total employment until plants are farther along.

H. H. Burrows Retires

Harold H. Burrows, senior vice president rubber sales, has retired after 45 years of service with the Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J. Joining the Division in 1915 as a billing clerk, he later became manager of the roll and tank departments, then sales manager of industrial rubber products division, and finally vice president of the corporation (on January 19, 1955). Mr. Burrows is particularly well known in the paper and pulp, rubber, chemical, and textile industries.

Equipment Purchases

(Continued from page 79)

to an all-time high and a generally soft tone in U. S. business.

The Division said the continued buoyancy in capital outlays reflected industry optimism that demand would continue to grow. It said expenditures abroad represent about one-quarter of the amount spent in the U. S. for capital investment. After declining from $61.5 million in 1957 to $51 million in 1958, foreign investment by U. S. rubber firms picked up to $54.5 million in 1959 and is expected to continue growing to $56.7 million in 1960 and $65.8 million in 1961.

Surveying the decade of the 1950's, the Division said direct investment in rubber products enterprises abroad rose from $182 million in 1950 to $460 million in 1959. The largest parts of the 1959 investments were in Latin America, $150 million; and Canada, with $142 million. Next came Europe, $70 million; Asia, $49 million; Oceania, $25 million; and Africa, $24 million.

news from abroad

West Europe's Wages Up More in Fifties

Wages of Western European workers, while still far below the U. S. average, climbed more rapidly than wages of American workers percentagewise during the decade just past, the *German American Trade News* reports.

The magazine notes that according to United Nations statistics, wages of American workers rose 51% between 1950 and 1959, but wages in every Western country except Italy rose faster. The increase in France was 139%, in West Germany 91%, in Great Britain 77%, in the Netherlands 61%, in Belgium 54%. The figure for Italy was 48%.

The increase in real wages followed a slightly different pattern, since in all countries price rises went along with rises in wages. The increase in West German real wages was 58%, France 43%, Belgium 27% and U. S. 25%. Great Britain, with 20%, the Netherlands, with 19%, and Italy, with 8%, trail behind.

One of the reasons for the greater percentage increase in West Europe is that wages are smaller than in the U. S., and a lower pay increase can mean a much larger percentage increase.

Here are the average hourly labor costs in the United States and Europe, as listed by the *German American Trade News:* United States, \$2.75; Sweden, \$1.08; West Germany, \$0.80; Great Britain, \$0.77; Switzerland, \$0.76; Belgium, \$0.73; France, \$0.71; Italy, \$0.61, and the Netherlands, \$0.57.

According to these figures, wage costs in the United States are nearly three times as high as the next highest, in Sweden, and three to four times as high as the rest of West Europe.

The dollar figures, however, do not tell the full story. In parts of West Europe, costs of social security and fringe benefits are considerably higher than in the United States. These would have to be added to hourly wage costs to get a true picture.

According to the Institut National de la Statistique et des Etude Economiques, fringe benefits for Italy are 74% of hourly wages; France 50%, West Germany 44.3%, Belgium 31%, the Netherlands 30.1%, and the U. S. 22.5%. Switzerland, with 15.4%, Sweden with 15.3%, and Great Britain, with 14%, complete the list.

To complete the picture, automation in Europe has resulted in a shorter work week, which is approaching the U. S. standard. Counting paid vacations and holidays, the average work week in the United States is 38 hours. In Germany it is 41.4 to 41.9; in France, 41.2 to 41.9; in Great Britain, 43.1 to 44.1; in Switzerland, 43.5 to 45.1; Netherlands, 45.6 to 46.2.

This 36-man overseas technical sales group from Cabot Corp. gathered in Surrey, England, to discuss ways of improving technical sales services for Cabot carbon blacks including the recently introduced Regal® series in overseas countries where Cabot is represented. Following the meeting Cabot Italiana S.p.A. officially became the corporation's fifth overseas company. In the back row *(left to right)* are Geoffrey de Bagneux (France); Len MacQueen, Reg Laffoley, and Ed Cheetham (U. K.); Vincent Maraux (France); David Christopher (U. K.); Don Patterson and Henri Figielski (France); Ray Rossman and Danny Dannenberg (U. S.); and Iain Horn (U. K.). Middle row: Don Harper and Guy Kuderer (France); Amendo Caliendo, Carlo Beer, and Piero Pasetto (Italy); Rollo Belsam, Bill Campaigne, and George Cash (U. K.); Denis O'Mulloy (France); James Satterfield, Bert King, Brian Thorley, and Bob Wood (U. K); and Daniel Lassailly (France). Front row: George Raymond (France); Ron Holder, Tom Bolt, Art Dobbin, John Andrews, and Bill Loving (U. S.); Ed Eaton (France); Umberto Massari and Charlie Beech (Italy); N. Scott (U. K.); and Cl. de Sercy (France)

The *German American Trade News* notes, however, that although wages are more than three times as high in the United States as in Germany, American producers get at least three times as much sales per person as in Germany. The reason is not so much differences in automation, a German source concludes, but a difference in organization. German companies have a large number of non-productive persons on their payrolls, while American firms tend to hire non-productive services, such as maintenance, cafeteria services, etc. The result is that American companies have a much more flexible cost structure which can be reduced when sales fail to keep up profits.

Malaya May Increase Taxes on Rubber

In connection with Malaya's 1961 budget, the Minister of Finance made two proposals which will hardly be welcomed by the rubber trade. First he proposed that the rate of export duty be adjusted to provide for an increase rising from 1/8 cent when the price is just above 80 cents, to about 2 cents, when it is at $1.00. Next—and worse—he wishes to change the anti-inflationary cess into a non-returnable tax.

With reference to the anti-inflationary cess, he is quoted as saying:

"It must always be borne in mind that taxation should be so framed that the quantum of tax should be directly related to ability to pay, and it cannot be seriously disputed that when the price of rubber is over $1.00 a pound . . . all rubber estates, including those which are not regarded as efficient, reap a rich harvest."

He added that the very fact that the levy was called an anti-inflationary cess implied that the extra profit represented by this cess could have adverse repercussions on the industry and the entire economy if it could not be siphoned off in times of great prosperity. Hence it could not be considered unfair of the government to ask for a bigger share of profits when they were in fact excessive and arose from world conditions of supply and demand and not from any increased effort by the industry. It was clear, he went on, that this additional levy would not hamper the industry at all, but it would aid the government and the people to raise the standard of living for the less fortunate.

Rubber in Ghana

Ghana, the former Gold Coast, is anxious to retrieve at least part of its former position as an important source of natural rubber, lost after 1911 as *Hevea* plantation rubbers in Asia proved their superiority over African wild rubber as to quality, yield, and cost of production. The Ghana Government has reportedly allocated $850,000 to subsidize *Hevea* cultivation in four areas in the western part of the country, considered most suitable for the purpose. Growers are to receive $84 an acre for the first 50 acres planted over a period of six years. It seems that work is to be on a cooperative basis. Stock will be supplied by the agricultural station at Ainyinase, 75 miles west of Tokaradi harbor, from the 100,000 *Hevea* seedlings it started in 1959. Adviser on the growing, preparing, grading, and marketing of the rubber is Albert V. McMullan, for 11 years rubber specialist with the United States Department of Agriculture and now attached to the Ainyinase station by agreement with the U.S. operations mission.

There are also two large rubber plantations in west Ghana, the Dixcove Estates, owned jointly by Danish and Ghanaian interests, and Prestea Estates at Avreboo, operated by the Agriculture Development Corp., which is the marketing agent for rubber (smoked sheet) in Ghana and also produces about 10 tons of rubber a month.

Dixcove, started in 1956, has 2,500 acres planted with 250 rubber trees to the acre and is expected to begin production within the next few years.

Its manager is J. Kjeldbeck, a Dane with 20 years' experience in Malaya.

Prof. Giulio Natta has been honored by the City of Milan, Italy, for outstanding scientific achievement. Known for his work in pioneering discoveries in stereospecific catalysis and stereoregular polymers, Professor Natta, director of the Institute of Industrial Chemistry, Polytechnic Institute of Milan, received a gold medal and an honor citation from the Mayor of Milan.

Processing Centers Help Smallholders

Local processing centers are helping Malayan smallholders with two to six acres of rubber in production to improve quality of their rubber and improve profits by cutting costs, the Natural Rubber Bureau reports.

The first center was set up in March of 1958 in the village of Sungei Marab, under the auspices of the Rubber Research Institute of Malaya. Surrounding smallholders were urged to bring their latex into the cooperative factory for conversion into smoked sheet.

So popular was the center that by the end of 1959 the Rubber Research Institute reported 33 cooperative, communal, or individual centers in operation, using RRI processing methods and equipment.

It reported that use of the center produces a product of Grades 1 and 2 sheet instead of the Grades 3 and 4 considered normal on smallholdings. The smoking of sheet by the producer also allows the sheet to be accurately graded at the time of sale, and a fair price to be obtained, the RRI said.

It also noted that bulk processing of all latex received at the center reduced cost of production and made possible bulk marketing, eliminating the charges of the small kampong dealer.

An estimated 40% of Malayan rubber comes from holdings of two to 100 acres.

Malayan Exports

Malayan rubber exports for the first 10 months of 1960 showed a drop of 11.3% from those for the same period of 1959; the totals were 884,483, and 997,284, respectively. The difference was caused primarily by the fantastic drop of 110,000 tons in shipments to Russia; the United States and Japan were the only other major consumers who reduced their 1960 purchases. Figures (in tons) for 1959 and 1960 for exports during the period to Malaya's 10 best customers follow:

	January-October	
	1959	1960
United Kingdom	134,622	134,958
United States	147,591	104,010
Japan	97,059	80,860
Russia	151,802	41,550
West Germany	67,958	81,389
Italy	41,009	46,397
Czechoslovakia	8,921	28,742
France	52,593	56,682
Poland	26,114	34,229
Spain	15,738	19,449

It will be noted that in 1960, Britain was Malaya's best customer, while Russia, which ranked first in 1959, has fallen to seventh place, after Italy. The United States is again second, despite the heavily reduced off-take; Germany has moved to third place, ahead of Japan.

Mohamed Zagden, Tunisian lecturer at the Tunis International Fair, October 14-30, explains why silicones make good electrical insulating materials. Silicones produced by Dow Corning Corp., Midland, Mich., were among products exhibited by 80 U. S. concerns at the Fair, which was expected to draw more than half a million visitors from southern Europe and North Africa. The Dow Corning exhibit showed electrical insulating materials, water repellents, and high-temperature paints, as well as medical and surgical uses for silicone rubbers

Forth Chemicals Plans Welsh Styrene Plant

Forth Chemicals, Ltd., a company owned two-thirds by British Hydrocarbon and one-third by Monsanto Chemicals, Ltd., will build a new styrene monomer plant between Neath and Port Talbot, South Wales. The plant, to be completed in two years at a cost of £3 million, will have an annual capacity of 50,000 tons.

Design and engineering of the new plant will be carried out by Monsanto Chemicals, Ltd., a subsidiary of Monsanto Chemical Co., Akron, O.

Forth Chemicals is the largest British manufacturer of styrene monomer. Its plant at Grangemouth, England, is in the midst of an expansion which will bring production to an estimated 50,000 tons of styrene a year.

Chinese Stocks High

The financial position of Chinese rubber dealers in Singapore has been one of the chief factors in the behavior of the rubber market during 1960, the *Financial Times* of London stated editorially early in November. Because these firms have such large reserves and hold such a dominating position in the Singapore market, it went on, stocks in the Far East have been able to accumulate to exceptionally high levels, while other markets remained relatively short. The dealers now appear to have strained their resources to the point where they must send at least some of their enormous stocks overseas to accumulate in other markets, the editorial continued, and it is believed that some fairly large consignments—the first such for several months—were shipped to the United Kingdom for arrival in London by the end of November.

Chinese rubber dealers in reply said that the reports that they have big stocks and must liquidate originated in consuming countries where it is hoped thereby to cause a drop in prices. That stocks in Singapore are large is agreed, but a spokesman for the dealers claimed that most of the stocks have been sold forward to consumers; he would give no figures, as that was "a business secret."

The fact that the 86,281 tons shipped from Malaya in October were 6,000 tons more than expected may have started the reports on liquidation of Singapore rubber stocks.

Meanwhile figures released in the beginning of December show that Pan-Malayan stocks at the end of October came to the record total of 154,462 tons, 21,772 tons more than in September.

Japan Cuts Production Of Synthetic Rubber

Nippon Synthetic Rubber Co. has suspended production at its plant in Yokkaichi because of large accumulated stocks exceeding 20,000 tons, four times Japan's monthly consumption.

The company, whose plants have a capacity of 35,000 tons a year of SBR, is reducing production to 25,000 tons for this year. Stocks had increased because the company had been unable to compete with the prices of imported rubber, the announcement said.

The Japanese Ministry of Trade is expected to ask Japanese industries to use more domestic synthetic rubber in order to help Nippon Synthetic, which is partly owned by the government.

Bayer Expands Range Of Synthetic Rubbers

Farbenfabriken Bayer A.G., Leverkusen, West Germany, is expanding production for Perbunan C (CR) to 25,000 tons a year, has added a room-temperature polymerized grade to its range of Perbunan N (NBR) rubbers, and is extending its range of Perbunan N grades to include percentage of nitrile higher than the present 28-38%. The company also plans to produce

(*Continued on page 114*)

Whether the need of bud-grafting could be avoided by the large-scale propagation of clones on their own roots has been the subject of recent work at the Rubber Research Institute of Malaya. Dr. Templeton *(left)* of the Malayan Institute discusses the propagation of *Hevea* cuttings with Ralph Wolf *(center)* of Natural Rubber Bureau, Washington, D. C., and I. H. Duckworth, of Malayan American Plantations.

market reviews

Soaring Production During 1960's Bringing Buyer's Market in Rubber

Natural Rubber

The drop in natural rubber prices during the past six months signals a changeover from the seller's market of the late 1950's to a buyer's market during the 1960's, H. C. Bugbee, president of the Natural Rubber Bureau, predicted.

The figures for 1965 production and consumption bear him out:

Increase in world consumption: 700,000 tons.

Increase in world production: 1,425,000 tons.

Surplus: 725,000 tons.

Bugbee's figures show world consumption of new rubber rising from approximately 3,800,000 tons in 1960 to 4,500,000 tons in 1965.

Figures supplied by President Ross R. Ormsby of The Rubber Manufacturers Association, Inc., in his year-end report show an increase in production of stereo rubbers from 5,000 long tons a year in 1960 to 375,000 long tons in the United States and 180,000 long tons in the remainder of the non-Soviet world by 1965.

Other reliable forecasts indicate an increase of 500,000 in production of non-stereo specific rubbers over the next five years, reaching a total of from 319,000 tons to 808,000 long tons in 1965.

Natural rubber production, according to Bugbee, will go from 2,060,000 long tons in 1960 to 2,810,000 long tons in 1970. Assuming an even increase, that would mean a production of 2,435,000 tons by 1965, or an increase of 375,000 tons over 1960 output.

This could mean a tremendous increase in competition during the next five years, unless rubber consumption gains much faster than predicted.

Bugbee said Malayan rubber growers have been expecting the change and, as a result, have increased their expenditures for research and replanting from $3,300,000 Malayan in 1953 to $12,000,000 Malayan this year.

Over the next few months rising production of rubber is expected to continue to push prices of natural rubber down, although the sharp drop in prices seems to be over.

Despite some recent purchases by Russian and Chinese sources, exceedingly low factory demand in the United States and Western Europe continues to have a depressing effect on prices. The United States Department of Commerce predicted that the present business slump will continue at least through the first half of this year; so no strong rise in prices seems likely.

During the November 16-December 15 period, prices dropped from 31.10¢ a pound to 28.26¢. Most of the drop, however, came during the first week, when the market was still absorbing news of Shell Chemical Co.'s cut in polyisoprene prices from 32¢ a pound to 27¢.

The General Services Administration suspended stockpile disposal sales when prices fell below 30¢, as required by law. This was the first time prices had fallen below 30¢ since the program started October 16, 1959.

The high price for near rubber during the year was 49.25¢ on July 27, the highest figures since 1955. The low was the December 15 figure, lowest since August, 1958.

November sales on the New York Commodity Exchange totaled 12,340 long tons, compared with 11,690 long tons during October. There were 20 trading days in November and 21 in the November 16-December 15 period.

REX CONTRACT

1960	Nov. 18	Nov. 25	Dec. 2	Dec. 9
Nov.	29.70	28.70	——	——
1961				
Jan.	30.00	29.35	28.50	28.80
Mar.	30.00	29.35	28.52	28.90
May	30.00	29.35	28.60	28.95
July	30.00	29.40	28.65	28.90
Sept.	30.00	29.40	28.65	28.90
Nov.	30.00	29.35	28.60	28.75
1962				
Jan.	——	——	28.60	28.75

On the physical market, according to the Rubber Trade Association of New York, RSS #1 averaged 30.67¢ in November and 29.17¢ for the November 16-December 15 period, compared with 34.03¢ in October and 32.53¢ for the October 16-November 15 period. Average November seller's prices were RSS #3, 30.42¢; Amber Blankets, 26.64¢; and Flat Bark, 24.28¢.

NEW YORK OUTSIDE MARKET

	Nov. 18	Nov. 25	Dec. 2	Dec. 9
RSS #1	30.13	29.37	28.50	28.85
#2	30.00	29.25	28.37	28.75
#3	29.85	29.13	28.25	28.63
Pale Crepe				
#1 Thick	32.25	31.75	30.50	30.75
Thin	32.00	31.50	30.50	30.75
#3 Amber Blankets	26.25	26.25	24.50	25.37
#3 Thin Brown Crepe	26.25	26.25	24.50	25.37
Standard Flat Bark	21.75	21.75	20.25	20.85

Latex

Buying interest in drum latex was definitely higher during the November 16-December 15 period, partly because of lower prices. The bulk latex market, however, was extremely quiet.

Production of latex in Malaya during October was 8,435 tons, against 9,325 tons in September. Stocks were up to 8,184 tons from 5,932 in September.

Prices for ASTM centrifuged concentrated natural latex, in tank-car quantities f.o.b. tank car, were down to 36.11¢ per pound solids, December 15, against 36.87¢, November 15.

(All figures in long tons, dry weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Sept.	0	2,541	4,250	12,852
Oct.	0	*	4,283	10,634
SBR				
Sept.	9,397	——	7,458	9,172
Oct.	9,063	——	7,371	10,000
Neoprene				
Sept.	1,119	0	942	1,494
Oct.	1,272	0	971	1,626
Nitrile				
Sept.	1,299	0	1,122	2,034
Oct.	1,176	0	1,118	1,999

* Not available yet for period covered.

market reviews

Synthetic Rubber

The U. S. market for new rubber will be little, if any, larger this year than it was last year, but synthetic rubber will get a larger share of the market, two rubber authorities predicted.

M. G. O'Neil, president of The General Tire & Rubber Co., forecast that U. S. industry will consume 560,000 long tons of new rubber this year, about the same as in 1960, but that the percentage of synthetic rubber consumption will rise to 70%, compared with 69% this year.

Ross R. Ormsby, president of The Rubber Manufacturers Association, Inc., predicted total new rubber use of 1,600,000 long tons, with 1,150,000 tons of it, or 72%, in synthetic. In 1959, 1,627,000 long tons of new rubber were consumed, but only 1,072,726 long tons, or 65%, were synthetic.

With a number of producers prepared to come on stream this year with production of polybutadiene, prospects seem to call for an even higher percentage of synthetic rubber use in the future. This will be helped by a recent cut in the price of butadiene from 14½¢ to 12¾¢. There is some possibility of further price cuts in the future as new SBR plants open overseas and exports drop off, since SBR now takes 85% of all butadiene production.

In his year-end RMA report, Ormsby estimated that production of synthetic rubber was 1,379,652 long tons in 1960, compared with 1,379,000 in 1959, and consumption 1,077,000 long tons, against 1,072,726 in 1959. Exports were estimated at 350,000 long tons, contrasted with 290,468 long tons in 1959. Shipments of passenger-car replacement tires reached 68,500,000, compared with 66,838,000 in 1959, and shipments for passenger, truck, and bus and farm tires, 123,180,000, compared with 116,358,000 in 1959.

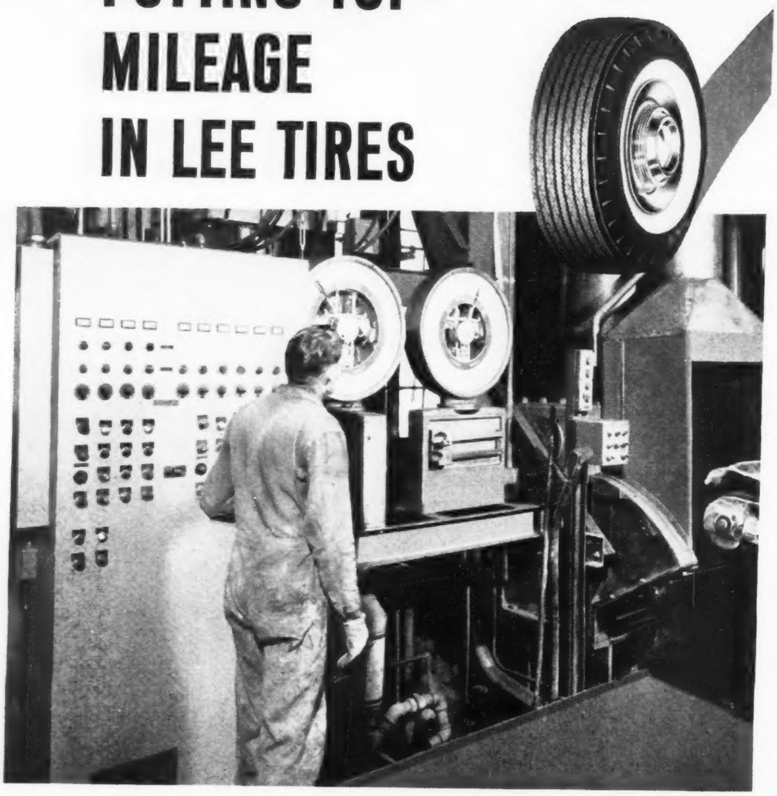
Consumption of new rubber in the United States for November amounted to 122,500 long tons, compared with 125,817 long tons consumed during October, according to the monthly report of The Rubber Manufacturers Association, Inc.

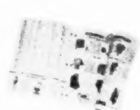
Consumption of all types of synthetic rubber during November totaled 86,585 long tons, against 88,784 long tons in October.

The ratio of synthetic rubber to total new rubber consumption inched up again, reaching 70.68% for November, compared with an October ratio of 70.5%. The ratio for the first 11 months of 1960 was 68.9% against 65.7% for the same period in 1959.

Natural rubber consumption for November was 35,915 long tons, contrasted with 37,033 long tons in October.

Production of synthetic rubber during November was estimated at 110,484 long tons; 110,991 long tons were produced in October. A total of 23,150 long tons was exported, compared with 22,903 long tons in October.





Consumption (in long tons) by type in November was: SBR, 73,240, against 74,606 in October; CR, 6,260, against 6,920 in October; IIR, 4,465, against 4,552; and NBR, 2,620, against 2,706.

Black masterbatch production in November was 6,110 long tons, compared with 4,148 in October; oil black masterbatch, 21,250 long tons, against 23,323 in October; oil masterbatch, 34,747 long tons, contrasted with 29,654 long tons in October.

Scrap Rubber

The scrap rubber market was quite tight for most of the year as reclaiming mills cut back their inventories and curtailed releases. Mixed tires were less in demand as manufacturers continued to send the scrap generated at their various outlets directly to their reclaiming divisions.

The export market showed no improvement except for tire tread buffings and No. 1 peels, which moved in substantial quantity to overseas markets. Closing of the St. Lawrence Seaway for the winter should curtail shipments of export from the Midwest, though it should continue from eastern markets.

Prices of butyl rubber tubes have trended downward during recent months, but promise to be much more stable this year than last.

The market slowed down during the November 16-December 15 period owing to end-of-the-year influences, but mixed auto tires fell off to \$7-11 in the East, the high side applicable only on shipments to Buffalo, and at \$11 in the Midwest. Mixed auto tubes dropped to 4.25¢ both in the East and the Midwest.

	Eastern Points	Akron, O.
	Per Net Ton	
Mixed auto tires	\$7.00/\$11.00	\$11.00
S.A.G. truck tires	nom.	nom.
Peeling, No. 1	nom.	25.00
2	nom.	nom.
3	nom.	nom.
	(¢ per Lb.)	
Auto tubes, mixed	4.25	4.25
Black	5.75	5.75
Red	nom.	nom.
Butyl	6.25	6.00

Reclaimed Rubber

The reclaimed rubber picture for the next five years will not be so "booming" as previously anticipated, but steady growth can still be expected, an eastern reclaimer predicted.

The other prediction was that business would continue slow through the first six months of this year, at about the same level as in the last part of 1960. After that, no one is making any guesses. The level of the reclaim in-

market reviews

dustry depends on the general economic level.

Investment abroad is expected to rise, and U. S. Reclaiming Co., Inc., Buffalo, N. Y., for one is thinking of switching from licensing arrangements for its Reclaimator process to joint ownership agreements in foreign countries. The company's Vicksburg, Miss., plant was expected to go on stream early in January.

According to the monthly report of The Rubber Manufacturers Association, Inc., 21,150 long tons of reclaimed rubber were produced in November, compared with 23,546 long tons in October. Consumption was 20,850 long tons, against 20,100 in October. Exports amounted to 1,050 long tons, contracted with 884 in October. Stocks were 32,800 long tons, down from the 33,519 long tons on hand at the end of October.

RECLAIMED RUBBER PRICES

Whole tire, first line	$0.115
Third line	.1075
Inner tube, black	.17
Red	.22
Butyl	.17
Light carcass	.22
Mechanical, light-colored, medium gravity	.185
Black, medium gravity	.10

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims, in each general group separately featuring characteristic properties of quality, workability, and specific gravity, at special prices.

Rayon and Nylon

This year promises to be one of very severe competition between the rayon and nylon tire cord makers, with the nylon makers shooting for the original-equipment market for either the 1962 or 1963 cars.

The improvement in nylon tire yarn announced by Chemstrand Corp. in mid-December is expected to be followed by similar announcements by other major producers. The major improvement is in fatigue resistance. The improved quality of nylon cord will be a selling point in the fight to take over the rayon market.

The other development to be expected this year is another price cut by the nylon manufacturers, set off by increasing production capacity as a number of new plants go on stream. Slim profit margins of rayon manufacturers make it unlikely that they will match any price cut.

Total packaged production of high-tenacity rayon yarn for November was 20.5 million pounds, compared with 19.5 million pounds in October. Shipments of high-tenacity yarn were 19.5 million pounds, against 18.2 million in October, and stocks at the end of November were 21 million pounds, compared with 21.1 million in October.

RAYON PRICES

Tire Fabrics	
1100/490/2	$0.69
1650/908/2	$0.58/.615
Tire Yarns	
High-Tenacity	
1100/ 490	.49
1100/ 980	.49
1150/ 490, 980	.49
1230/ 490	.49
1650/ 980	.55
1875/ 980	.55
2200/ 980	.55
Super-High Tenacity	
1650/ 720	.55

NYLON PRICES

Tire Yarns	
840/140	.92
1680/280	.92

obituaries

Franklin Farley

Franklin Farley, former president of the Chlor-Alkali division of Food Machinery & Chemical Corp., New York, N. Y., died November 24 in Lakeland, Fla.

He began his career as an engineer with Washington Marine Insurance Co. and then went to Arthur D. Little, Inc. Later he served as vice president for Phosphate Mining Co. and International Minerals & Chemicals Corp. before joining FMC in 1954 as a management consultant. He was president of the Chlor-Alkali division from 1955 to 1957 and then again was management consultant until he retired last September.

Mr. Farley, who was born in 1894 in Bellaire, O., and was educated at the University of Kansas, was a member of the American Institute of Chemical Engineers, American Society of Mechanical Engineers, and American Association for the Advancement of Science.

Surviving him are his wife, his daughter, and a brother.

John R. Busser

John R. Busser, for the past four years general manager of the Sherman Rubber Machinery Co., Worcester, Mass., died of a heart attack on December 1 in Worcester, Mass., at the age of 69.

A leading developer of new concepts in rubber machinery, Mr. Busser was also associated, previously, with Lawrence Barry Co., Medford, Mass., as sales engineer (1938-1953) and with New England Rubber Machinery Co., Boston, as sales manager (1953-1956).

Funeral services were held December 3 in Worcester.

He is survived by a wife, two sons, and two grandsons.

Synthetic Rubbers and Latices*

Monomers

11-80, 100, 200, 112-3 Triols	lb.	$0.225	
11-300	lb.	.265	
-400	lb.	.325	
Acrylonitrile	lb.	.27	
Butadiene	lb.	.15	
Dow Styrene	lb.	.12	
H99, N99	lb.	.205	
RG	lb.	.17	
Vinyltoluene	lb.	.17	
Hylene M	lb.	1.25	/ $2.55
M-50	lb.	.86	/ 2.36
T	lb.	.85	/ 2.41
TM	lb.	.70	/ 2.26
-65	lb.	.75	/ 2.31
Isobutylene	gal.	.38	
Isoprene	lb.	.25	
Mondur-C	lb.	1.05	
Multron R-2	lb.	.54	
P200	lb.	.23	
Rohm & Haas ethyl acrylate	lb.	.34	/ .36
Glacial methacrylic acid	lb.	.40	/ .425
Methyl acrylate	lb.	.37	/ .39
Methylacrylate	lb.	.29	/ .31

Shortstops

4P Mercaptan	lb.	.27	/ .31
DDM	lb.	.94	/ .975
Mercaptan 174	lb.	.38	/ .50
Sharstop 204	lb.	.38	/ .42
268	lb.	.52	/ .53
Tecquinol	lb.	.825	/ .845
Thiostop K	lb.	.50	/ .53
N	lb.	.38	/ .47
Vulnapol KM	lb.	.52	/ .56
NM	lb.	.38	/ .42
Wingstop B	lb.	.38	

Acrylic Types

Acrylon BA-15	lb.		1.25[a]
EA-5	lb.		1.00[a]
Hycar 4021	lb.	1.34[c]	/ 1.35[c]

Latices

Hycar 2600X30, 2600X39, 2601	lb.	.50	/ .56

Butadiene Types (BR†)

Cis-1	lb.	.35[b]	/ .50[b]

Cold BR Latex

Pliolite Latex 2104			.325

Fluorocarbon Types

Fluorel KF-2141	lb.	10.00	/ 10.25
Kel-F Elastomer	lb.	15.00	/ 16.00
5500, 820 (Latex)	lb.	15.00	/ 17.15
Viton A, AHV	lb.	10.00	/ 10.25
B	lb.	13.00	

Isobutylene Types (IIR)

Enjay Butyl 035, 065, 150, 215, 217, 218, 325			.23[a]
165, 268, 365			.24[a]
Hycar 2202		.65[c]	/ .75[c]
Polysar Butyl 100, 200, 300, 400			.245[c]
101			.2775[a]
301			.255[c]
Vistanex LM			.45[a]
MM			.35[a]

Neoprene Types (CR)

Neoprene Type AC, AD, CG		.55[a]	.575[a]
FB		.65[a]	/ .675[a]
GN, GN-A, WB, WX		.41[a]	/ .435[a]
GRT, S		.42[a]	/ .445[a]
KNR		.75[a]	/ .775[a]
W, WHV		.39[a]	/ .415[a]
WD		.45	/ .475
W-M1		.40[a]	/ .415[a]
WRT		.45[a]	/ .475[a]

Latices

Neoprene Latex 571, 842-A		.37[a]	/ .47[a]
572		.39[a]	/ .49[a]
60, 601-A		.40[a]	/ .50[a]
635		.41[a]	/ .51[a]
400, 650		.42[a]	/ .52[a]
735, 736		.38[a]	/ .48[a]
750		.39[a]	/ .49[a]
950		.47[a]	/ .57[a]

Nitrile Types (NBR)

Butaprene NF			.49[b]
NH			.65[b]
NL			.50[b]
NXM			.58[b]
Chemigum, N1NS			.64[b]
N3NS, N5			.58[b]
N6, N-6B, N7, N8			.50[b]
N600			.50[b]
Hycar 1001, 1041		$0.58[c]	/ $0.59[a]
1002, 1042, 1043, 1052, 1053, 1312		.50[c]	/ .51[c]
1014		.60[c]	/ .61[c]
1072		.64[c]	/ .65[c]
1411		.62[c]	/ .63[c]
1432, 1441		.59[c]	/ .60[c]
Paracril, AJ		.485[c]	/ .495[a]
B, BJ, BJLT, BLT		.50[c]	/ .51[a]
C CLT		.58[c]	/ .59[a]
CV		.63[c]	/ .64[c]
D		.65[c]	/ .66[c]
OZO		.46[c]	/ .47[c]
18-80		.60[c]	/ .61[c]
Polysar Krynac 800, 802, 803			.50[c]
801			.58[c]

Latices

Butaprene N-300			.46[b]
N-400, N-401			.54[b]
Chemigum 200			.49[b]
235 CHS, 236			.54[b]
245 B, 245 CHS, 246, 247, 248			.46[b]
Hycar 1512, 1552, 1562, 1577		.45[c]	/ .52[c]
1551, 1561, 1571		.53[c]	/ .60[c]
1852		.46[a]	/ .52[c]
Nitrex 2612		.45[a]	/ .52[a]
2616		.53[a]	/ .60[a]
2619		.52[a]	/ .59[a]
2620, 2625		.45[a]	/ .52[a]
Tylac 640,650		.45[c]	/ .52[c]
750		.49[c]	/ .56[c]
850		.53[c]	/ .60[c]
1640,1650		.54[c]	/ .61[c]

Polyethylene Type

Hypalon 20	lb.		.47[a]
30	lb.		.60[a]
40	lb.		.50[a]

Polysulfide Type

Thiokol LP-2, -3, -31, -32, -33			.96[a]
-8			1.35[a]
-205			4.00[a]
Type-A			.50[a]
FA			.69[a]
ST			1.25[a]

Latices

Thiokol Latex (dry wt.) Type MX			.80[a]
WD-2			1.25[a]
-6		.80[a]	/ 1.25[a]

Silicone Types

GE (compounded)		2.29[c]	/ 4.90[a]
Silicone gum		3.85[c]	/ 4.55[c]
Silastic (compounded)		2.95[b]	/ 3.50[b]
(Partly compounded)		3.15[b]	/ 3.60[b]
(Uncompounded)		4.05[b]	/ 4.35[b]
LS-53		12.00	/ 16.30
Union Carbide (compounds)		2.35[b]	/ 3.20[b]
(Gums)		3.85[b]	/ 4.25[b]

Styrene Types (SBR)‡

Hot SBR

Ameripol 1000, 1001, 1006, 1007		.241[c]	/ .247[c]
1002		.2435[c]	/ .2495[c]
1006 Crumb		.2475[c]	/ .2535[c]
1009		.2475[c]	/ .2535[c]
Crumb		.259[c]	/ .265[c]
1011		.2475[c]	/ .2535[c]
1012		.2425[c]	/ .2485[c]
Crumb		.249[c]	/ .255[c]
1013		.241[c]	/ .247[c]
Crumb		.2615[c]	/ .2675[c]
ASRC 1004, 1006		.241[c]	/ .2475[c]
1009		.2475[c]	/ .2535[c]
1018		.27[c]	/ .276[c]
1019		.265[c]	/ .271[c]
Copo 1006			.241[c]
FR-S 1000, 1001, 1004, 1006		.241[c]	/ .247[c]
1007		.241[c]	/ .247[c]
1009		.2475[c]	/ .2535[c]
1010		.26[c]	/ .266[c]
1012		.2425[c]	/ .2485[c]
1013		.241[c]	/ .247[c]
Crumb		.2615[c]	/ .2675[c]
1014		.281[c]	/ .287[c]
141		.28[c]	/ .286[c]
181		.241[c]	/ .247[c]
Naugapol 1016, 1019		.265[b]	/ .27[b]
1015		.35[b]	/ .355[b]
1018		.27[b]	/ .275[b]
1022		.305[b]	/ .31[b]
1023		.33[b]	/ .335[b]
6003		.27[b]	/ .275[b]
Philprene 1000, 1001, 1006, 6701		.241[b]	/ .247[b]
1009		.2475[b]	/ .2535[b]
1018		.27[b]	/ .276[b]
1019		.265[b]	/ .271[b]
Plioflex 1006		.241[c]	/ .247[c]
Polysar S-630		.241[c]	/ .247[c]
S-X-371		.255[c]	/ .261[c]
S-1000, -1006, -1013			.23[a]
-1002, -1011			.2325[a]
-1009			.24[a]
Synpol 1000, 1001, 1006, 1007, 1013, 1061		.241[b]	/ .247[b]
1002		.2435[b]	/ .2495[b]
1009		.2475[b]	/ .2535
Synpol 1012		$0.2425[b]	/ $0.2485[b]
8000		.241[b]	/ .247[b]
X-274		.255[c]	/ .261[c]

Hot SBR Black Masterbatch

Philprene 1100			.194
1104			.190[b]
S-1100			.185[a]

Hot SBR Latices

Copo 2000			.2775[c]
FR-S 2000, 2001		.2725[c]	/ .3425[c]
2002		.35[c]	/ .36[c]
2003, 2004		.305[c]	/ .36[c]
2006		.29[c]	/ .382[c]
Naugatex 2000, 2001		.2775[a]	/ .3575[a]
2002		.30[a]	/ .37[a]
2006		.29[a]	/ .42[a]
Pliolite Latex 2000, 2001			.2825
2076			.295[c]
Polysar Latex II			.29[c]
IV			.2775
S-2000, 2006			.26[a]

Cold SBR

Ameripol 1500, 1501. 1502, 4600, 4601		.241[c]	/ .247[c]
ASRC 1500, 1502		.241[c]	/ .247[c]
1503		.2625[c]	/ .2685[c]
3105, 3106		.241[c]	/ .247[c]
3110		.26[c]	/ .266[c]
C-102			.23[a]
Copo 1500, 1502, 1507, 1510			.241[c]
1505-NS			.261[c]
FR-S 1500, 1502, 146, 179		.241[c]	/ .247[c]
127		.26[c]	/ .266[c]
Gentro 1500			.241
Naugapol 1503		.2625[b]	/ .2675[b]
1504		.35[b]	/ .355[b]
6100		.32[b]	/ .325[b]
Philprene 1500, 1502		.241[b]	/ .247[b]
1503		.2625[b]	/ .2685[b]
6630		.251[b]	/ .257[b]
6631		.241[b]	/ .247[b]
Plioflex 1500C, 1502, 1507, 1510		.241[c]	/ .247[c]
Polysar Kryflex 200			.251[c]
252			.27[c]
Krylene NS			.241[a]
SS-250, SS-250-Flake			.2875[c]
S-1500, S-1502			.23[a]
1509			.23[a]
Synpol 1500, 1502, 1551, 8103		.241[b]	/ .247[b]

Cold SBR Black Masterbatch

Ameripol 1605		.19[c]	/ .196[c]
4651		.177[c]	/ .183[c]
4659		.182[c]	/ .188[c]
4660		.187[c]	/ .193[c]
4664		.1845[c]	/ .1905[c]
4667		.208[c]	/ .214[c]
B-129			.1960[c]
-134			.1900[c]
-172			.1825[c]
Baytown 1600, 1601, 1602			.193[b]
8675, 8677			.182[b]
8676			.1876[b]
8678			.208[b]
8679			.2022[b]
8680			.1775[b]
8681			.1835[b]
Carbomix 1606			.182[c]
1608			.1845[c]
1609			.208[c]
1811			.1569[c]
CB-102			.185[a]
Gentro-Jet 9152			.208
9153			.182
9154			.1845
Philprene 1601		.193[b]	/ .199[b]
1603		.196[b]	/ .202[b]
1605		.19[b]	/ .196[b]
1606		.182[b]	/ .188[b]
1608		.1845[b]	/ .1905
1609		.208[b]	/ .214[b]
6655		.194[b]	/ .20[b]
S-1600, -1602			.1825[a]
-1605			.18[a]
-1606, -1607			.175[a]
-7652			.1875[a]
Synpol 8151		.182[b]	/ .188[b]
8152		.186[b]	/ .192[b]

Cold SBR Oil Masterbatch

Ameripol 1705		.2035[c]	/ .2095[c]
1707, 1708		.191[c]	/ .197[c]
1710, 1712		.1885[c]	/ .1945[c]
4700		.175[c]	/ .181[c]
ASCR 1703		.206[c]	/ .212[c]
1708		.191[c]	/ .197[c]
1712		.1885[c]	/ .1945[c]
1713		.175[c]	/ .181[c]
Copo 1712			.1885[c]
1713			.175[c]
1714			.1725[c]
1773			.206[c]
1778			.191[c]
FR-S 1703		.206[c]	/ .212[c]
1710		.1885[c]	/ .1945[c]
1712		.1885[c]	/ .1945[c]
123		.196[c]	/ .202[c]
154, 155		.1885[c]	/ .1945[c]
173		.206[c]	/ .212[c]
178		.191[c]	/ .197[c]
Gentro 1712			.1885
Philprene 1703		.206[b]	/ .212[b]
1708		.191[b]	/ .197[b]
1712		.1885[b]	/ .1945[b]

(*Continued on page 114*)

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
* Prices are per pound carload of tank-car dry weight unless otherwise specified.
† BR—Butadiene rubber.
‡ SBR—Styrene-butadiene rubber.

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.74 /	.81
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator B	lb.	.92	
49	lb.	.60 /	.61
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.92	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.54 /	.56
Amax	lb.	.75 /	.77
No. 1	lb.	.71 /	.73
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.68
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butazate	lb.	1.04	
Butyl Eight	lb.	1.10 /	1.35
Namate	lb.	.45 /	.50
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Captax	lb.	.44 /	.46
Conac S	lb.	.76 /	.78
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Cydac	lb.	.71 /	.73
Cyuram DS, powder	lb.	1.14	
Pellets	lb.	1.14	
MS, powder	lb.	1.14	
Pellets	lb.	1.14	
Cyzate B, E	lb.	.87 /	.89
Delac-S	lb.	.71 /	.73
DIBS	lb.	.85 /	.87
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.69 /	.70
Du Pont	lb.	.69 /	.70
DPG (diphenylguanidine)			
Cyanamid	lb.	.51 /	.52
Monsanto	lb.	.51 /	.57
El-Sixty	lb.	.62 /	.64
Ethazate	lb.	1.04	
50-D	lb.	.87 /	.89
Ethyl Seleram	lb.	3.00	
Thiurad	lb.	1.04	
Thiuram	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ziram	lb.	.89 /	1.04
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.62 /	.64
Hepteen Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.44 /	.46
Du Pont	lb.	.44 /	.46
Naugatuck	lb.	.44 /	.49
-XXX, Cyanamid	lb.	.55 /	.57
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.54 /	.56
Du Pont	lb.	.54 /	.56
Naugatuck	lb.	.54 /	.56
-W Cyanamid	lb.	.60 /	.62
Merac #225	lb.	.75 /	1.05
Mertax	lb.	.55 /	.57
Methazate	lb.	1.04	
Methyl Thiuram	lb.	1.14	
Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Cyanamid	lb.	.88 /	.90
Du Pont	lb.	1.00	
NA-22	lb.	1.05	
NOBS No. 1	lb.	.71 /	.73
Special	lb.	.75 /	.77
O-X-A-F	lb.	.55 /	.57
Pennac SDB	lb.	.45 /	.48
Pentex	lb.	1.24	
Flour	lb.	.30	
Permalux	lb.	2.25	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
Polyac Pellets	lb.	1.85	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.55 /	.57
RZ-50, -50B	lb.	1.00	
S.A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	3.00	
Santocure	lb.	.71 /	.73
NS	lb.	.71 /	.73
Selenacs	lb.	3.00	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Sulfads	lb.	1.98	
Tellurac	lb.	1.30 /	1.55
Tepidone	lb.	$0.45	
Tetrone A	lb.	1.98	
Thiates	lb.	.88 /	$1.25
Thiofide	lb.	.54 /	.56
Thionex	lb.	1.14	
Thiotax	lb.	.44 /	.46
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.58
Base	lb.	1.03 /	1.06
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
T.M.D.	lb.	1.14	
ZB, ZE, ZM	lb.	.85 /	.89
Z-B-X	lb.	2.45	
Zenite	lb.	.54 /	.56
A	lb.	.69 /	.71
AM	lb.	.76 /	.78
Special	lb.	.55 /	.57
Zetax	lb.	.55 /	.57
Zimate	lb.	1.04	
ZMBT	lb.	.55 /	.57

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.1425/	.1575
Eagle, sublimed	lb.	.1435	
National Lead, sublimed	lb.	.1585	
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.1475	
National Lead	lb.	.1625/	.1645
PRD-90	lb.	.38 /	.50
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.17 /	.18
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.1425	
National Lead	lb.	.165 /	.175
Zinc oxide, comml.†	lb.	.145 /	.155

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.65	
Capital 170	lb.	.20 /	.25
171	lb.	.1425/	.1925
225, 258, 710	lb.	.14 /	.19
261	lb.	.155 /	.18
262	lb.	.16 /	.185
263	lb.	.1775/	.2025
270	lb.	.1175/	.1425
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1225/	.1725
G-M-F	lb.	2.60 /	2.65
PDD-70	lb.	2.70 /	3.00
PGD-25	lb.	1.25 /	1.50
Groco 30	lb.	.1325/	.1825
Guantal	lb.	.62 /	.64
Hyfac 410	lb.	.1425/	.1675
430	lb.	.18 /	.205
431	lb.	.2025/	.2275
Hystrene S-97	lb.	.1863/	.2125
T-45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.37 /	.39
MODX	lb.	.295 /	.345
NA-22	lb.	1.05	
PND-70	lb.	1.35 /	1.60
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.135 /	.185
Groco 2, 4, 8, 18	lb.	.1375/	.1875
Welcoline	lb.	.21 /	.42
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1525/	.1775
150	lb.	.18 /	.205
Hydrofoil 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco 56	lb.	.115 /	.14
Rufat 75	lb.	.1062/	.1325
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1475/	.1725
Groco 53	lb.	.1525/	.1775
Wilmar 253	lb.	.1525/	.1775
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1575/	.1825
Wilmar 254	lb.	.1575/	.1825
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.20
Wilmar 255	lb.	.1875/	.2075
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.54 /	.56
Vimbra	lb.	.32 /	.385
Vulklor	lb.	.88 /	.98
Wilmar 110	lb.	.17 /	.22
434	lb.	.1425/	.1925
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeRite Alba	lb.	$2.40 /	$2.50
Gel	lb.	.70 /	.72
H. P.	lb.	.79 /	.81
Hipar	lb.	1.05 /	1.07
Powder	lb.	.57 /	.59
Resin	lb.	.88 /	.90
D	lb.	.57 /	.59
Spar	lb.	.57 /	.59
Stalite	lb.	.57 /	.59
S	lb.	.57 /	.59
Superlite	lb.	.57 /	.59
White	lb.	1.50 /	1.60
Akroflex C	lb.	.85 /	.87
CD	lb.	.79 /	.81
Albasan	lb.	.69 /	.73
Allied AA 1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.57 /	.59
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.59 /	.61
Aranox	lb.	3.25	
Betanox Special	lb.	.94 /	.96
B-L-E, -25	lb.	.57 /	.59
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
CAO-1	lb.	.37 /	.86
-5	lb.	1.49 /	1.63
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.54 /	1.00
Deenax	lb.	.95	
Flectol H	lb.	.57 /	.59
Flexamine	lb.	.79 /	.81
Heliozone	lb.	.31 /	.32
Ionol	lb.	.91 /	1.65
Microflake	lb.	.20 /	.24
Naugawhite	lb.	.57 /	.59
NBC	lb.	1.67	
Neozone A	lb.	.64 /	.66
C	lb.	.86 /	.88
D, Special	lb.	.57 /	.59
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Nonox CI	lb.	1.50 /	1.67
WSL	lb.	1.50 /	1.60
WSP	lb.	1.47 /	1.60
Octamine	lb.	.57 /	.59
PDA-10	lb.	.46 /	.48
Pennox A, C, D	lb.	.57 /	.59
B	lb.	.67 /	.69
Permalux	lb.	2.25	
Polygard	lb.	.57 /	.59
Polylite	lb.	.55 /	.60
Protector	lb.	.41	
Rio Resin	lb.	.70 /	.72
Santoflex			
75	lb.	1.01 /	1.03
AW	lb.	.71 /	.73
DD	lb.	.57 /	.59
Santovar A	lb.	1.55 /	1.57
Santowhite Crystals, Powd.	lb.	1.55 /	1.57
L	lb.	.57 /	.59
MK	lb.	1.25 /	1.27
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof-713	lb.	.26 /	.27
Improved	lb.	.25 /	.26
Jr.	lb.	.22 /	.23
Tenamene 3	lb.	.91 /	1.05
Thermoflex A	lb.	1.05 /	1.07
Tonox	lb.	.54 /	.59
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.75 /	.80
Wing-Stay S, T	lb.	.55 /	.67
Zalba	lb.	1.10	
Zenite	lb.	.52 /	.54

Antiozonants

Eastozone 30, 31	lb.	1.05 /	1.09
32	lb.	1.15 /	1.20
Flexone 3-C	lb.	2.00	
6-H	lb.	1.25 /	1.27
Nonox ZA	lb.	1.99 /	2.00
Santoflex AW	lb.	.71 /	.73
Tenamene 30, 31	lb.	1.24 /	1.28
Tysonite	lb.	.30 /	.307
UOP 88, 288	lb.	1.05 /	1.07
Wing-Stay 100	lb.	1.00 /	1.08

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.
† For trade names, see Color—White, Zinc Oxide.

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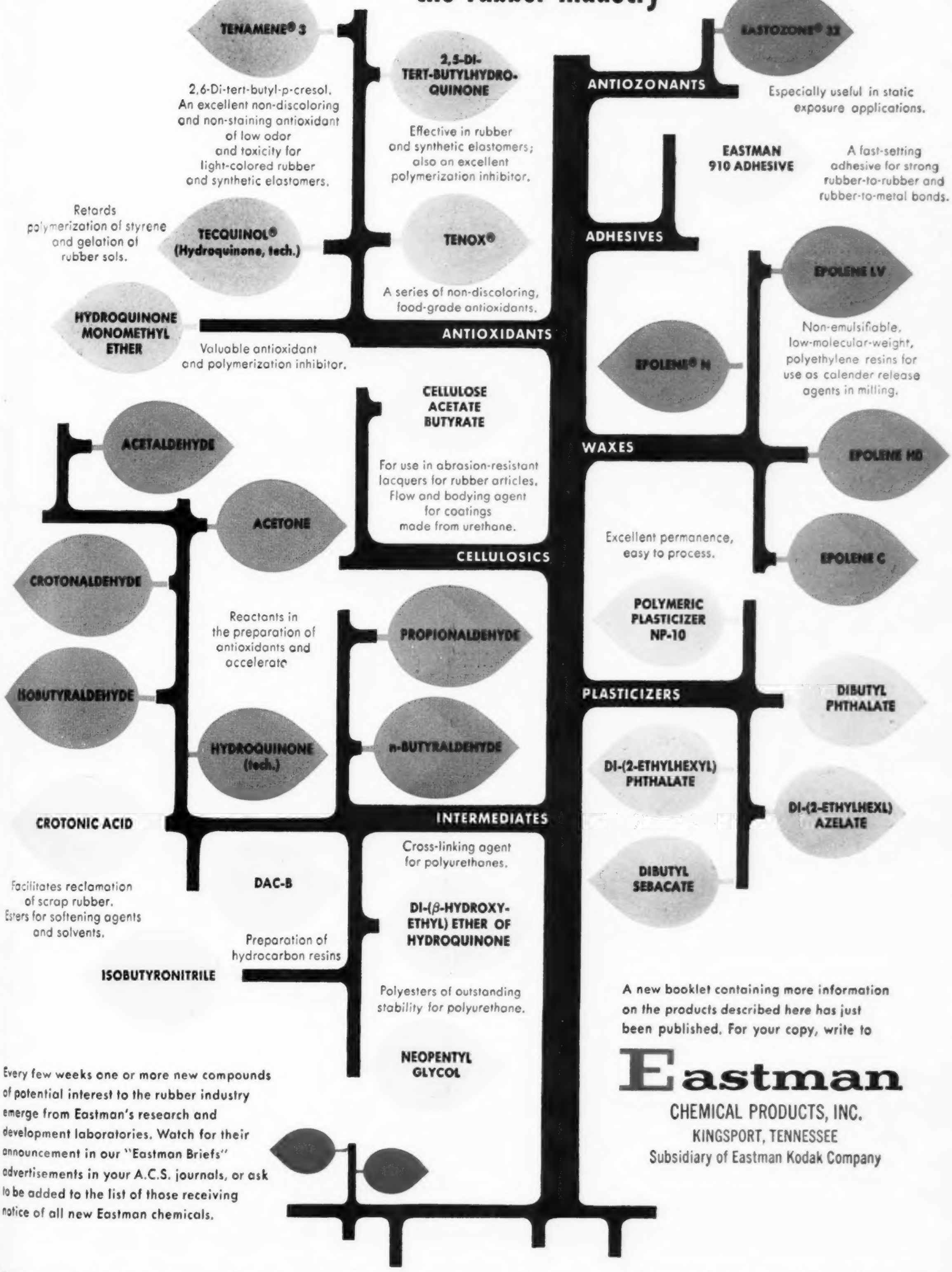

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Blowing Agent 8110S	lb.	$0.32 /	$0.35
Celogen	lb.	1.95	
-80	lb.	1.60	
-AZ	lb.	1.92	
Kempore R-125	lb.	1.92	
Opex 40	lb.	.72	
PL-80	lb.	1.44	
Sodium bicarbonate	100 lbs.	2.55 /	3.85
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.72	
NDX	lb.	1.44	
S	lb.	.20	
Vulcacel BN	lb.	1.36 /	1.51
BMC	lb.	.68 /	.79

Bonding Agents

Brase	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Chemlok 201, 203	gal.	5.00 /	7.50
220	gal.	9.25 /	12.00
401	gal.	11.70 /	14.40
602	gal.	25.00 /	26.00
607	gal.	18.00	
614	lb.	4.35 /	4.75
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Hylene M	lb.	1.25 /	2.75
M-50	lb.	.86 /	2.36
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Thixons	gal.	1.48 /	12.00
Ty Ply, BN, Q, S, UP, 3640	gal.	6.75 /	8.00
BC	gal.	4.50 /	6.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.26 /	.35
Kosmos/Dixie BB	lb.	.23 /	.30
Texas MC-74-BD	lb.	.26 /	.35
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.08 /	.1625
Kosmobile 77/Dixiedensed 77	lb.	.085 /	.1625
Micronex W-6	lb.	.08 /	.1625
Spheron #9	lb.	.085 /	.1625
Texas E	lb.	.08 /	.1625
Witco #12	lb.	.08 /	.1625
Wyex EPC	lb.	.08 /	.1625

Medium Processing Channel—MPC

Arrow MPC	lb.	.08 /	.1625
Continental A	lb.	.08 /	.1625
Kosmobile S-66/Dixiedensed S-66	lb.	.085 /	.1625
Micronex Standard	lb.	.08 /	.1625
Spheron #6	lb.	.085 /	.1625
Texas M	lb.	.08 /	.1625
Witco #1	lb.	.08 /	.1625

Conductive Furnace—CF

Aromex CF	lb.	.0875/	.155
Continex CF	lb.	.11 /	.17
Vulcan C	lb.	.110 /	.185
SC	lb.	.18 /	.255
XC-72	lb.	.25 /	.34

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.0625/	.135
Continex FEF	lb.	.0625/	.135
Kosmos 50/Dixie 50	lb.	.0675/	.135
Philblack A	lb.	.0675/	.135
Statex M	lb.	.0625/	.135
Sterling SO	lb.	.0675/	.135

Fine Furnace—FF

Statex B	lb.	.0675/	.14
Sterling 99	lb.	.0725/	.14

High Abrasion Furnace—HAF

Aromex HAF	lb.	.0725/	.145
Continex HAF	lb.	.0725/	.145
Kosmos 60/Dixie 60	lb.	.0775/	.145
Philblack O	lb.	.0775/	.145
Statex R	lb.	.0725/	.145
Vulcan #3	lb.	.0775/	.145

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.0875/	.16
Continex ISAF	lb.	.0875/	.16
Kosmos 70/Dixie 70	lb.	.0925/	.16
Philblack I	lb.	.0925/	.16
Statex 125	lb.	.0875/	.16
Vulcan 6	lb.	.0925/	.16

General-Purpose Furnace—GPF

Arogen GPF	lb.	.055 /	.1275
Continex GPF	lb.	.055 /	.1275
Kosmos 35	lb.	.06 /	.1275
Statex G	lb.	.055 /	.1275
Sterling V	lb.	.06 /	.1275
Non-staining	lb.	.06 /	.1275

High Modulus Furnace—HMF

Continex HMF	lb.	$0.0575/	$0.13
Kosmos 40/Dixie 40	lb.	.0625/	.13
Modulex HMF	lb.	.0625/	.13
Statex 93	lb.	.0575/	.13
Sterling L, LL	lb.	.0625/	.13

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.0525/	.125
Essex SRF	lb.	.0525/	.125
Furnex	lb.	.0525/	.125
Gastex	lb.	.0625/	.135
Kosmos 20/Dixie 20	lb.	.0575/	.125
Pelletex, NS	lb.	.0575/	.125
Regal	lb.	.0575/	.125
Sterling NS, S	lb.	.0575/	.125
R	lb.	.0625/	.135

Super Abrasion Furnace—SAF

Aromex SAF	lb.	.1150/	.1825
Kosmos 85	lb.	.115 /	.19
Philblack E	lb.	.115 /	.19
Statex 160	lb.	.11 /	.19
Vulcan 9	lb.	.115 /	.19

Fine Thermal—FT

P-33	lb.	.0575/	.0625
Sterling FT	lb.	.0625	

Medium Thermal—MT

Sterling MT	lb.	.045	
Non-staining	lb.	.055	
Thermax	lb.	.04 /	.045
Stainless	lb.	.05 /	.055

Awaiting Classification

Neotex 100	lb.	.0725/	.145
130	lb.	.0875/	.16
150	lb.	.11 /	.19
Regal 300	lb.	.0775/	.145
600	lb.	.0925/	.16

Colors

Black

Iron oxides, comml.	lb.	.1235/	.135
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico pure synthetic	lb.	.1475/	.15
Lampblack, comml.	lb.	.16 /	.45
Superjet	lb.	.085 /	.12
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue G, R	lb.	2.38	
C. P. Iran Blues	lb.	.52 /	.54
Du Pont	lb.	2.55 /	4.75
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Solfast	lb.	1.60 /	3.25
Stan-Tone Violet Blue			
D-4000	lb.	3.45	
4001	lb.	3.00	
4002	lb.	.90	
4900	lb.	1.97 /	2.15
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml.	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1575/	.16
Sienna, burnt, comml.	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, comml.	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml.	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, comml.	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan	lb.	.2325/	.235
Metallic brown pure synthetic	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.42 /	.45
Green	lb.	.80 /	2.40
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	.42 /	.45
Green G	lb.	3.00	
Lincoln Green	lb.	5.30 /	6.60
G-4099-6099	lb.	.4450/	.4525
GH-9869	lb.	1.10 /	1.25
9976	lb.	1.20 /	1.35
Du Pont	lb.	2.05 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Permansa	lb.	$1.45	
Serene	lb.	3.50	
Solfast	lb.	1.60 /	$3.35
Stan-Tone			
D-5000	lb.	3.95	
5001	lb.	.82	
5400	lb.	1.50	
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Benzidine 12193	lb.	3.30	
Cyanamid Permatons	lb.	1.56	
Dianisidine 10406	lb.	2.85	
Du Pont	lb.	2.25	
Molybdate	lb.	.49	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone			
Light orange 70 PCO3	lb.	2.48 /	2.76
D-7003	lb.	3.97 /	4.17
Orange 70 PCO4	lb.	2.80 /	3.08
D-7004	lb.	4.23 /	4.43
7104	lb.	1.85 /	2.05
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Arcturus CP-1270	lb.	1.35	
Brilliant Toning Red	lb.	.77 /	1.90
Cadmium red lithopones	lb.	2.21 /	3.77
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.91 /	2.00
Naphthol Red, Scarlet	lb.	2.95 /	3.80
Du Pont	lb.	2.00 /	2.05
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml.	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico pure synthetic	lb.	.1425/	.145
Recco	lb.	.12	
Williams Red	lb.	.13 /	.1525
Lake Red C, CP-1104	lb.	1.25	
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Plasticone	lb.	1.02 /	4.60
Rub-Er-Red	lb.	.0975	
Solfast	lb.	1.60 /	1.80
Stan-Tone			
70 PCO5	lb.	3.00 /	3.28
D-2000	lb.	1.25	
2110, 2120, 2121	lb.	.98	
2200	lb.	1.47	
2500	lb.	1.90	
2600	lb.	4.60	
2601	lb.	1.60	
2700		1.75	
2800	lb.	1.90	
Light Red D-7005	lb.	4.68 /	4.88
7105	lb.	1.97 /	2.17
Red 70 PCO6	lb.	3.35 /	3.63
D-7006	lb.	4.89 /	5.09
-7106	lb.	2.20 /	2.40
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.04 /	.0675

White

Antimony oxide	lb.	.27 /	.285
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith lithopone	lb.	.0825/	.0912
Titanium pigments			
Horse Head Anatase	lb.	.255 /	.27
Rutile	lb.	.275 /	.29
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.255 /	.265
C-50	lb.	.1438/	.1488
RA, -10, -50	lb.	.275 /	.285
RC	lb.	.0963/	.1013
-HT, -HTX	lb.	.0963/	.0988
Rutile	lb.	.205 /	.29
Unitane	lb.	.255 /	.29
Zopaque Anatase	lb.	.245 /	.27
Zinc oxide, comml.	lb.	.145 /	.1825
Azo ZZZ-11, -44, -55	lb.	.145 /	.155
12% leaded	lb.	.125 /	.135
35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675
Eagle AAA, lead free	lb.	.145 /	.155
5% leaded	lb.	.145 /	.155
35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675
Florence Green Seal	lb.	.1625/	.1725
Red Seal	lb.	.1575/	.1675
White Seal	lb.	.1675/	.1775
Horsehead XX-4, -78	lb.	.145 /	.155
Kadox-15, -17, -72, -515	lb.	.145 /	.155
-25	lb.	.15 /	.16
Lehigh, 35% leaded	lb.	.15375/	.16375
50% leaded	lb.	.1575/	.1675

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

SILICONE NEWS from Dow Corning

New Process Aid

Silicone Coated Papers Speed Processing of Sticky Products

When processing sticky materials and products, such as raw rubber, candy or resin-bonded laminates, "stickers" can cause lost time and extra cost. They can, but don't . . . if you specify interleaving or process papers with the new Syl-off® silicone stickproof coatings. Syl-off coated papers give quick, easy and complete removal of sticky products, help keep production moving smoothly, hold product waste to a minimum.

AIDS PACKAGING, TOO. Syl-off coated paper and paperboard are now used in packaging a variety of sticky products . . . from asphalt to sweet rolls, from adhesive masses to candied fruits. Standard containers available with Syl-off coated liners or inner surfaces include multiwall bags, fiber drums, unit containers, cores and cartons. Pan liners and wrappers coated with food grade Syl-off may be used in contact with food in compliance with the provisions of the Food Additives Amendment of 1958.

MORE ADVANTAGES. Syl-off coatings have natural nonoily lubricity and water repellency . . . won't migrate, contaminate or transfer . . . won't alter the characteristics of paper stock. Whether you process, ship or receive sticky materials, Syl-off coated papers are worth looking into. For the complete list of Approved Sources, plus a descriptive brochure, write Dow Corning, Dept. 7913.

For complete technical information about any silicone product, contact the Dow Corning office nearest you.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Zinc Oxide (*Cont'd*)			
Protox-166, -167	*lb.*	$0.145 /	$0.155
St. Joe, lead free	*lb.*	.145 /	.175
Zinc sulfide, comml.	*lb.*	.253 /	.263
Cryptone ZS	*lb.*	.253 /	.263

Yellow

Benzidine 12199	*lb.*	.58 /	2.55
Cadmium yellow lithopones	*lb.*	1.12 /	1.15
Cadmolith	*lb.*	1.12 /	1.20
Chrome	*lb.*	.135 /	.145
Cyanamid Hansa Yellow	*lb.*	2.20	
Du Pont	*lb.*	2.25	
Filo	*lb.*	.10	
Iron oxide, comml.	*lb.*	.0525 /	.1175
Lansco synthetic	*lb.*	.1075	
Mapico pure synthetic	*lb.*	.12 /	.1275
Williams	*lb.*	.115 /	.1225
Lightfast Benzidine 12220	*lb.*	3.40	
Monsanto Yellow 14	*lb.*	1.91	
10010	*lb.*	1.91	
BYP-282	*lb*	1.21	
GA	*lb.*	2.45	
S-10010	*lb.*	1.17	
Stan-Tone			
D-1100	*lb.*	2.55	
1101	*lb.*	.69	
Lemon 70 PCO1	*lb.*	1.77 /	2.19
D-7001	*lb.*	2.80 /	3.00
Medium yellow 70 PCO2	*lb.*	1.79 /	2.21
D-7002	*lb.*	2.98 /	3.18
Vansul masterbatch	*lb.*	.95 /	1.95
Williams Ocher	*lb.*	.0575/	.06

Dusting Agents

Antidust	*lb.*	.37 /	.41
Diatomaceous silica	*ton*	32.00 /	48.00
Extrud-o-Lube, conc.	*gal.*	1.33 /	1.69
Glycerized Liquid Lubricant, concentrated	*gal.*	1.25 /	1.63
Glyso-Lube, #3	*lb.*	.14	
Latex-Lube GR	*lb.*	.20	
Pigmented	*lb.*	.1825	
R-66	*lb.*	.165	
Liqui-Lube	*lb.*	.1625	
N. T.	*lb.*	.1675	
Liquizinc No. 305	*lb.*	.30 /	.35
Lubrex	*lb.*	.25 /	.30
Mica 160 Biotite	*lb.*	.065 /	.0725
Mesh	*lb.*	.08 /	.0875
325 Mesh	*lb.*	.0825/	.09
Concord	*lb.*	.08 /	.09
Mineralite	*ton*	45.00	
Pigmented Separex, LG	*lb.*	.105	
Slab-Dip, S-20	*lb.*	.11 /	.15
Pyrax A	*ton*	14.50 /	15.00
W. A.	*ton*	17.00 /	17.50
Rexanol	*lb.*	.13	
Talc, comml.	*ton*	18.40 /	38.50
EM	*ton*	11.00 /	63.00
LS Silver	*ton*	29.25	
Nytals	*ton*	28.00 /	38.00
Sierra Sagger 7	*ton*	34.00	
White IR	*ton*	19.75	
III	*ton*	20.75	
Vanfre	*gal.*	1.95 /	3.00
Wet-Zinc, CW, P	*lb.*	.20 /	.2225

Extenders

BRS 700	*lb.*	.02 /	.036
BRT 7	*lb.*	.035 /	.036
Cumar Resins	*lb.*	.095 /	.19
Dielex B	*lb.*	.06	
Factice, Amberex	*lb.*	.29 /	.36
Brown	*lb.*	.1425/	.263
Neophax	*lb.*	.157 /	.268
White	*lb.*	.144 /	.285
G. B. Asphaltenes	*lb.*	.097 /	.177
Millex, W	*lb.*	.07	
Mineral Rubbers			
Black Diamond	*ton*	38.00 /	40.00
Hard Hydrocarbon	*ton*	53.00 /	60.00
Hydrocarbon MR	*ton*	45.00 /	55.00
Parmr	*ton*	21.00 /	29.00
T-MR Granulated	*ton*	47.50 /	50.00
Nuba No. 1, 2	*lb.*	.0575/	.0625
3X	*lb.*	.0775/	.0825
OPD-101	*lb.*	.26	
Rubber substitute, brown	*lb.*	.16 /	.2572
Car-Bel-Ex A	*lb.*	.14	
Car-Bel-Lite	*lb.*	.35	
Extender 600	*lb.*	.1765	
White	*lb.*	.192 /	.2103
Stan-Shells	*ton*	35.00 /	73.00
Sublac Resin PX-5	*lb.*	.215 /	.235
Sundex 53	*gal.*	.12	
85	*gal.*	.1725	
Synthetic 100	*lb.*	.41	
Vistanex L grades	*lb.*	.35	

Fillers, Inert

Agrashell flour	*ton*	50.00 /	74.00
Albacar	*ton*	55.00 /	75.00
Barytes, floated, white	*ton*	49.00 /	70.85
No. 1	*ton*	55.00 /	77.50
2	*ton*	50.00 /	72.50
Off-color, domestic	*ton*	25.00	
Sparmite	*ton*	95.00 /	117.00
Blanc fixe	*ton*	100.00 /	165.00
Burgess HC-75	*ton*	12.00 /	30.00
80	*ton*	14.00 /	32.00
Iceberg	*ton*	50.00 /	80.00
Pigment #20	*ton*	35.00 /	60.00
#30	*ton*	37.00 /	60.00
WP #1	*ton*	11.00 /	16.00
Camel-Carb	*ton*	$14.00	
-Tex	*ton*	22.00	
-Wite	*ton*	35.00	
Cary #200	*ton*	30.00 /	$55.00
CCC #1	*ton*	10.50 /	12.50
"G"	*ton*	15.00 /	17.00
Citrus seed meal	*lb.*	.04	
Oil	*lb.*	.15	
Diatomaceous silica	*ton*	32.00 /	48.00
Flocks			
Cotton, dark	*lb.*	.095 /	.135
Dyed	*lb.*	.55 /	.60
White	*lb.*	.13 /	.33
Fabrifil X-24-G	*lb.*	.135	
X-24-W	*lb.*	.235	
Filfloc 6000	*lb.*	.33	
F-40-900	*lb.*	.135	
HSC #35 Silicone Emulsion	*lb.*	1.22 /	2.46
Hydrite	*ton*	25.00 /	50.00
Kalite	*ton*	52.50 /	67.50
Lithopone, comml.	*lb.*	.075 /	.085
Eagle	*lb.*	.0725/	.075
Permolith	*lb.*	.08 /	.0875
Sunolith	*lb.*	.075 /	.0825
Mica, 160 Biotite	*lb.*	.065 /	.0725
Mesh	*lb.*	.08 /	.0875
160 Mesh, 325 Mesh	*lb.*	.075 /	.09
Concord	*lb.*	.08 /	.09
Millical	*ton*	38.00 /	53.00
Mineralite	*ton*	40.00 /	60.00
Non-Fer-Al	*ton*	35.00 /	50.00
Ohio Superspray lime	*ton*	16.50	
Pulverized limestone, Stonelite	*ton*	8.25 /	11.00
Purecal M,O	*ton*	58.50 /	85 00
Pyrax A	*ton*	14.50 /	15.00
W. A.	*ton*	17.00 /	17.50
Sawdust	*ton*	14.00 /	35.00
Silversheen Mica	*lb.*	.08 /	.09
Stan White	*ton*	10.50 /	13.10
Super-White Silica	*ton*	25.00 /	46.50
Surfex	*ton*	37.50 /	52.50
MM	*ton*	42.00 /	57.00
Suspenso	*ton*	38.00 /	53.00
Ti-Cal	*lb.*	.0675	
Walnut shell flours	*ton*	50.00 /	84.00
Whiting, limestone			
Atomite	*ton*	32.50 /	35.00
Calcite	*ton*	23.00	
Calwhite	*ton*	20.00 /	27.00
-T	*ton*	23.00	
Duramite	*ton*	20.00	
Gamaco	*ton*	32.50 /	40.00
Keystone	*ton*	20.00 /	22.00
Laminar	*ton*	30.00	
No. 10 White	*ton*	11.00 /	16.50
Omya	*ton*	30.00	
BSH	*ton*	45.00	
Paxinosa	*ton*	14.50 /	22.50
Snowflake	*ton*	17.00 /	18.00
Witco	*ton*	13.00	
York	*ton*	9.50	

Note

Suppliers are requested to submit product additions or deletions and price changes promptly as they occur in order that we may make the listing of maximum service to our readers. Comments on the present listing and classifications are invited with a view toward facilitating location of specific items.

Correspondence should be directed to Market Editor, RUBBER WORLD, 630 Third Avenue, New York 17, New York.

Finishes

Apex Bright Finish #5200-E	*lb.*	.25	
Rubber Finish	*gal.*	2.50	
Black-out	*gal.*	4.50 /	8.00
Flocks, Rayon, colored	*lb.*	.90 /	1.50
White	*lb.*	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Paraflint RG and RGU Synthetic Wax	*lb.*	.15 /	.22
Rubber lacquer, clear	*gal.*	1.00 /	2.00
Shellacs, Angelo	*lb.*	.485 /	.7325
Vac Dry	*lb.*	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	*lb.*	.15 /	.20
Wax, Bees	*lb.*	.67 /	.83
Carnauba	*lb.*	.57 /	1.13
Monten	*lb.*	.27	
Neutral	*gal.*	.76 /	1.31
No. 118, colors	*gal.*	.86 /	1.41
Van Wax	*gal.*	2.00 /	2.05

Latex Compounding Ingredients

Acintol D, DLR	*lb.*	.0625/	.085
FA #1	*lb.*	.0675/	.09
#2	*lb.*	.0825/	.105
Accelerator 552	*lb.*	$2.25	
Accelerator J-117, -302	*lb.*	1.00 /	$1.15
-144	*lb.*	.15 /	.30
-307	*lb.*	1.10 /	1.25
-311	*lb.*	.60 /	.75
Aerosol, dry types	*lb.*	.65 /	.80
Liquid types	*lb.*	.40 /	.75
Alcogard 354	*lb.*	1.40 /	1.42
Alcogum AK-12	*lb.*	.12 /	.14
AN-6	*lb.*	.055 /	.06
-10	*lb.*	.09 /	.10
-25	*lb.*	.31	
PA-15	*lb.*	.16	
Alrosol	*lb.*	.41	
Amberex solutions	*lb.*	.1675/	.18
Antifoam J-114	*lb.*	3.25 /	3.45
P-242	*lb.*	.24 /	.35
Antioxidant J-137, -140	*lb.*	.55 /	.70
-139, -293	*lb.*	1.45 /	1.60
-182	*lb.*	2.00 /	2.15
-186	*lb.*	1.40 /	1.55
2246	*lb.*	1.50 /	1.53
Anti Webbing Agent J-183	*lb.*	.75 /	.90
-297	*lb.*	.27 /	.40
Aquablak B	*lb.*	.1075/	.1175
G	*lb.*	.13 /	.14
K	*lb.*	.13 /	.14
M	*lb.*	.12 /	.13
Aquarex D	*lb.*	.81	
G	*lb.*	.21	
L	*lb.*	.94	
MDL	*lb.*	.33	
ME	*lb.*	.82	
Aquarex NS	*lb.*	.60	
SMO	*lb.*	.50	
WAQ	*lb.*	.22	
Ben-A-Gels	*lb.*	.98 /	1.40
Bentone 18, 18C	*lb.*	.45	
34	*lb.*	.60	
Casein	*lb.*	.22	
Cellosize WP-09, -3, -40, -300	*lb.*	1.00 /	1.17
CW-12	*lb.*	.85	
-37	*lb.*	.70	
DC Antifoam A Compound	*lb.*	5.45 /	6.65
B	*lb.*	.63 /	1.10
Emulsion	*lb.*	2.05 /	4.00
AF Emulsion	*lb.*	2.05 /	2.85
Compound 7	*lb.*	5.13 /	6.50
Defoama W-1701	*lb.*	.125	
Defoamer 115a	*lb.*	.50	
NDW	*lb.*	.215 /	.235
Dispersing Agents			
Blancol	*lb.*	.1525/	.26
N	*lb.*	.155 /	.26
Darvan Nos. 1, 2, 3	*lb.*	.22 /	.30
Daxad 11, 21, 23, 27	*lb.*	.08 /	.30
Dispersaid H7A	*lb.*	.58	
1159	*lb.*	.43	
Emulphor ON-870	*lb.*	.50 /	.70
Igepal CO-630	*lb.*	.2875/	.47
Igepon T-73	*lb.*	.285 /	.495
T-77	*lb.*	.45 /	.69
Indulins	*lb.*	.06 /	.08
Kreelons	*lb.*	.132 /	.155
Laurelton Oil	*lb.*	.18	
Leonil SA	*lb.*	.52 /	.65
Lomar PW	*lb.*	.18	
Marasperse CB	*lb.*	.1225/	.1425
N	*lb.*	.095 /	.105
Modicols	*lb.*	.17 /	.58
Nekal BA-75	*lb.*	.395 /	.54
BX-76	*lb.*	.63 /	.75
Nopco 1287	*lb.*	.155 /	.195
Orzan A	*lb.*	.0325	
S	*lb.*	.0425	
Pluronics	*lb.*	.335 /	.40
Polyfons	*lb.*	.08 /	.09
Sorapon SF-78	*lb.*	.28 /	.40
Tergitol 7	*lb.*	.4125/	.44
NPX	*lb.*	.275 /	.3074
TMN	*lb.*	.2875/	.32
Trenmine W-30	*lb.*	.15	
W-40	*lb.*	.60 /	.75
Triton R-100	*lb.*	.12 /	.25
X-100, -102, -114	*lb.*	.255 /	.36
Dispersions			
Agebest 1293-22	*lb.*	1.90 /	2.00
AgeRite Alba	*lb.*	3.00	
Powder, Resin D	*lb.*	.80	
White	*lb.*	1.80	
Altax	*lb.*	.75	
Shield No. 2, 6	*lb.*	.08	
3	*lb.*	.095	
4-35	*lb.*	.09	
5	*lb.*	.093	
7-F, 8	*lb.*	.165	
- 55	*lb.*	.18	
Iron Oxide, 60%	*lb.*	.40	
L.S.W.	*lb.*	1.50	
No. 305 Liquizinc	*lb.*	.30 /	.35
P-33	*lb.*	.35	
Rotax	*lb.*	.75	
Sulfur	*lb.*	.13 /	.15
Telloy	*lb.*	3.62	
Tuads, Methyl	*lb.*	1.60	
Vulcacure NB	*lb.*	.45	
NS	*lb.*	.75 /	1.05
T.M.D.	*lb.*	1.14	
ZB, ZE, ZM	*lb.*	.85 /	.89
Vulcanizing, C group	*lb.*	.40 /	1.30
G group	*lb.*	.45 /	.90
N group	*lb.*	.40 /	1.00
Zetax	*lb.*	.75	
Zimates, Butyl	*lb.*	1.30	
Ethyl, Methyl	*lb.*	1.35	
Zinc oxide	*lb.*	.40	
Emulsions			
AgeRite Spar	*lb.*	1.00	

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Box No. 2492, c/o RUBBER WORLD

TECHNICAL EDITOR

with rubber technology experience to assist editor with industry and association contacts, article solicitation and preparation, and original contributions. Must be able to type, but proficiency not required. Send résumé and salary requirements to:

R. S. Walker, Editor
RUBBER WORLD

PRACTICAL RUBBER CHEMIST FOR QUALITY CONTROL AND production supervision of molded rubber products. Medium-size plant located in Phila. area. Address Box No. 2545, care of RUBBER WORLD.

TECHNICAL MAN FOR TRANSPARENT DIPPED GOODS. MUST know complete set-up. Write Box No. 2546, care of RUBBER WORLD.

SITUATIONS WANTED

RUBBER TECHNOLOGIST: OVER FIFTEEN YEARS' DIVERSIFIED background in mechanical rubber goods, seeks responsible position in development or production. Experience includes compounding, manufacturing, supervision, management, development, cost estimation, raw materials, etc. Address Box No. 2548, care of RUBBER WORLD.

TECHNICAL SALES AND/OR SERVICE POSITION DESIRED. Background entails compounding, development, production, as well as sales and service to the rubber and allied industries. Address Box No. 2549, care of RUBBER WORLD.

MACHINERY AND SUPPLIES FOR SALE

— FOR SALE —

4—Blaw Knox 6' x 40' horizontal vulcanizers with quick-opening doors, 250# working pressure, ASME.
2—Royle #½ extruders, complete.
1—Peerless guillotine cutter, 30" blade, with motor.
1—Allen 4" extruder with 25-HP. motor.
Address Box No. 2547, care of RUBBER WORLD.

FOR SALE: CONTINUOUS RUBBER OR PLASTICS COMPOUNDING and extruding installation. Consists of: 1—Welding Engineers 6" dual worm extruder driven by 200-H.P. motor and drive, XP. 1—Welding Engineers 8" dual worm extruder, 40-H.P. gear-head motor, XP. Compounding unit constructed of S. S. 316—Baker Perkins—Cascade kneaders —consisting of 3 size 14 Banbury-type kneaders. Each rotor individually powered by 30-H.P. gear-head motor, XP. Complete with electrical equipment and controls. Capacity 3 tons to 10 tons per day. PROCESS PLANTS SERVICE, INC., 287 Central Ave., Clark, N. J., Tel. FUlton 1-1103.

FOR SALE: BAKER-PERKINS #15-UUMM DISPERSION BLADE double-arm mixer, 100-gallon, jacketed, 100-HP explosion-proof motor, motorized tilt, cored blades, compression ram cover. Also 200-gallon B-P mixers. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

FOR SALE—LABORATORY MILLS—6 x 12", 6 x 13", 6 x 16", 8 x 18", self-contained with reduction drive, brake, and motor. Prompt Delivery. RUBBER & PLASTIC MACHINERY OF NEW JERSEY, P. O. Box 1543, Trenton, New Jersey.

FARREL 16" x 40" TWO-ROLL MILL, OTHER SIZES UP TO 60". Hydraulic Presses: 300-ton upstroke 40" x 30". 300-ton upstroke 22" x 35". 240-ton upstroke with ten 24" x 56" platens. 200-ton Williams & White 24" x 24" platens. 200-ton Farrel 30" x 30". Farrel 150-ton, 36" x 36". Also other sizes. MPM 3½" wire covering Extruder. Adamson 6" Rubber Extruder. New and used Laboratory 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders. Baker-Perkins and Day heavy-duty jacketed Mixers up to 200 gallons. Hydraulic pumps and Accumulators. Peerless 2-HP. Rubber Bale Cutter. Rotary Cutters. Taylor-Stiles 7½-HP. Rubber Pelletizer. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107—8TH STREET, BROOKLYN 15, NEW YORK. STERLING 8-1944.

Emulsions (*Cont'd*)			
AgeRite Stalite	lb.	$0.75	
Superiite	lb.	1.00	
Borden Arcco A-25, A-26			
7.16-30	lb.	.18 /	$0.19
555-40R	lb.	.185 /	.2025
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Habuco Resin Nos. 502,			
515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Hyonic PE 250	lb.	.255 /	.295
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Ludox	lb.	.1675/	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Modical S	lb.	.3084/	.3284
VD	lb.	.1384/	.1584
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD 101	lb.	.16 /	.26
Picco Latex Plasticizer A-12	lb.	.069 /	.096
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse #3 Paste	lb.	.26 /	.30
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905 /	.975
ST	lb.	.585 /	.615
30A	lb.	.245 /	.265
Setsit #5	lb.	.75 /	1.05
#9	lb.	.85 /	1.15
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Vult-Accel E	lb.	.85 /	.92
Webnix	lb.	1.50 /	2.50

Mold Lubricants

A-C Polyethylene	lb.	.275 /	.52
Acintol D	lb.	.0625/	.085
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.225 /	.2825
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.3375/	.3575
Colite Concentrate	gal.	.90 /	1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14 /	4.75
200 Fluid	lb.	3.14 /	4.75
Compound 4, 7	lb.	5.13 /	6.50
Emulsion 7	lb.	1.20 /	1.74
8, 35, 35A, 35B, 36	lb.	1.20 /	1.74
ELA	lb.	.82	
FT Wax 200	lb.	.265 /	.42
300	lb.	.295 /	.45
Glycerized Liquid Lubricant,			
concentrated	gal.	1.25 /	1.63
Igepals	lb.	.2875/	.74
Igepon AP-78	lb.	.44 /	.68
T-43	lb.	.145 /	.35
-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
L-45 Silicone Oil	lb.	2.90 /	4.61
LE-45 Silicone Oil Emulsion	lb.	1.15 /	1.69
-450 Silicone Emulsion	lb.	1.15 /	1.69
L-520 Organo-Silicone Fluid	lb.	2.46 /	3.50
-522 Organo-Silicone Fluid	lb.	2.68 /	3.50
Lubrex	lb.	.27 /	.32
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
Mold Lubricant No. 426	lb.	.18	
Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
MR-22	gal.	9.95 /	14.95
Para Lube	lb.	0.46 /	.048
Paraflint RG and RGU Synthetic Wax	lb.	.15 /	.22
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Pluronics	lb.	.335 /	.44
Poly-Brite PE-20	lb.	.28 /	.42
600	lb.	.42 /	.58
Poly-Cone 125X	lb.	1.20 /	1.40
1000	lb.	.93 /	1.06
Polyglycol E series	lb.	.29 /	.42
RA-1, -2, -3	gal.	2.25 /	3.00
Rubber Glo	gal.	.94 /	.97
Silrex S-1	lb.	.65	
SM-33, -55, -61, -62	lb.	1.22 /	1.76
Soap, Hawkeye	lb.	1.25 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20 /	1.25
Stoner's 800 series	gal.	$1.26 /	$1.70
900 series	gal.	1.55 /	2.55
A series	gal.	1.80 /	4.50
Ucon 50-HB Series	lb.	.25 /	.375
Ulco	lb.	.12 /	.23
Vanfre	gal.	1.95 /	3.00
XLE-420 Silicone Oil Emulsion	lb.	1.18 /	1.70

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rodo	lb.	4.00 /	5.50
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

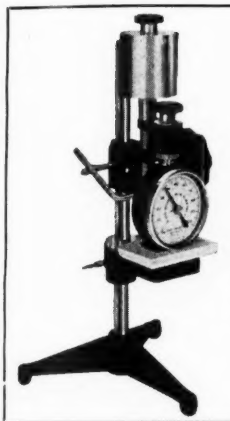
Plasticizers and Softeners

Acintol DLR	lb.	.0625/	.085
Adipol 2EH, 10A, XX	lb.	.40 /	.44
BCA	lb.	.45 /	.475
ODY	lb.	.40 /	.44
Admex 710	lb.	.3325/	.3625
711	lb.	.3325/	.3825
744	lb.	.3925/	.3825
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.0275/	.0375
B	lb.	.055 /	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.555 /	.605
BRC-20	lb.	.022 /	.0245
22	lb.	.026 /	.0285
30	lb.	.0165/	.025
521	lb.	.023	
BRH 2	lb.	.0341/	.0351
BRS 700	lb.	.036	
BRT 7	lb.	.035 /	.036
BRV	lb.	.0625/	.065
Bunarex Liquid	lb.	.0875/	.0925
Resins	lb.	.085 /	.095
Bunatak AH	lb.	.085 /	.095
N	lb.	.31	
U	lb.	.175	
83	lb.	.0685	
90	lb.	.09	
210	lb.	.14	
Bunnatol G, S	lb.	.40 /	.505
Butac	lb.	.1735/	.1835
Butyl stearate, comml	lb.	.255	
B-17	lb.	.22 /	.26
Binney & Smith	lb.	.23 /	.26
FMC	lb.	.2725/	.2825
Harchem	lb.	.2525/	.3425
Kessoflex	lb.	.245 /	.275
Butyl stearate—G.P.	lb.	.0125/	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.02
Califlux 510, 550	lb.	.0275/	.0375
G.P.	lb.	.015 /	.0225
R-100	lb.	.0475/	.0575
T-T	lb.	.019 /	.0295
Capryl alcohol, comml	lb.	.195 /	.30
Columbian Carbon	lb.	.195 /	.30
Harchem	lb.	.195 /	.30
Chlorowax 40	lb.	.1625/	.1825
70	lb.	.185 /	.245
-S	lb.	.21 /	.27
Circo light	gal.	.17	
Circosol-2XH	gal.	.185	
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol)			
Darax	lb.	.32 /	.3475
DBP (dibutyl phthalate),			
comml	lb.	.26 /	.40
Darex	lb.	.30 /	.33
Eastman	lb.	.285 /	.29
Harflex 140	lb.	.275 /	.315
Harwick Std. Chem. Co.	lb.	.325 /	.385
Hatco	lb.	.30 /	.33
Monsanto	lb.	.285 /	.325
Naugatuck	lb.	.30 /	.33
PX-104	lb.	.26 /	.30
Rubber Corp. of America	lb.	.285 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate)			
comml	lb.	.66 /	.69
Eastman	lb.	.655 /	.685
Harflex 40	lb.	.655 /	.685
Hatco	lb.	.66 /	.685
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.685
DCP (dicaprylphthalate),			
comml	lb.	.295 /	.325
Harflex 180	lb.	.26 /	.30
Hatco	lb.	.295 /	.325
Monoplex	lb.	.30 /	.315
DDA (didecyladipate)			
Good-rite GP-236	lb.	.40 /	.59
Kessoflex	lb.	.40 /	.435
DDP (didecylphthalate)			
Good-rite GP-266	lb.	.295 /	.45
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate)			
Darex	lb.	.4325/	.4625
Eastman	lb.	.40 /	.44
Ohio-Apex	lb.	.41 /	.45
DIDA (diisodecyladipate)			
Monsanto	lb	$0.40 /	$0.44
RC	lb.	.40 /	.44
DIDP (diisodecylphthalate)			
Darex	lb.	.32 /	.35
Harflex 110	lb.	.265 /	.305
Monsanto	lb.	.26 /	.30
Ohio-Apex	lb.	.41 /	.45
PX-120	lb.	.26 /	.30
RC	lb.	.265 /	.305
Dielex B	lb.	.06	
Diethylene glycol, comml	lb.	.1525/	.1825
Wyandotte	lb.	.15 /	.165
Di-2 ethylhexyl azelate	lb.	.455 /	.495
Dinopol IDO	lb.	.265 /	.305
DIOA (diisooctyladipate)			
Kessoflex	lb.	.40 /	.435
Naugatuck	lb.	.435 /	.465
PX-208	lb.	.40 /	.435
Rubber Corp. of America	lb.	.40 /	.44
DIOP (diisooctylphthalate),			
comml	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.25 /	.29
Harflex 120	lb.	.26 /	.30
Hatco	lb.	.305 /	.335
Monsanto	lb.	.26 /	.30
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.26 /	.30
PX-108	lb.	.26 /	.30
Rubber Corp. of America	lb.	.26 /	.30
Sherwin-Williams	lb.	.32 /	.34
DIOS (diisooctylsebacate),			
comml	lb.	.61 /	.64
Rubber Corp. of America	lb.	.5925/	.6325
DIOZ (diisooctylazelate)			
Cabflex	lb.	.48 /	.51
Dipolymer Oil	gal.	.33 /	.48
Dispersing Oil No. 10	lb.	.06 /	.0625
DNODA (di-n-octyl-n-decyl adipate), Monsanto	lb.	.40 /	.44
DOA (dioctyladipate),			
comml	lb.	.425 /	.455
Eastman	lb.	.40 /	.44
Good-rite GP-233	lb.	.40 /	.55
Harflex 250	lb.	.40 /	.435
Hatco	lb.	.435 /	.465
Monsanto	lb.	.40 /	.44
Naugatuck	lb.	.435 /	.465
PX-238	lb.	.40 /	.435
Rubber Corp. of America	lb.	.40 /	.44
DOP (dioctylphthalate),			
comml	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Eastman	lb.	.265 /	.30
Good-rite GP-261	lb.	.285 /	.44
Harflex 150	lb.	.26 /	.30
Hatco	lb.	.305 /	.335
Monsanto	lb.	.26 /	.30
Naugatuck	lb.	.305 /	.335
Ohio-Apex	lb.	.25 /	.29
Polycizer 162	lb.	.28 /	.435
PX-138	lb.	.25 /	.29
Rubber Corp. of America	lb.	.25 /	.30
Sherwin-Williams	lb.	.305 /	.335
DOS (dioctylsebacate)			
comml	lb.	.61 /	.64
Eastman	lb.	.61 /	.64
Harflex 50	lb.	.5925/	.6225
Hatco	lb.	.61 /	.635
Monoplex	lb.	.61 /	.635
Naugatuck	lb.	.615 /	.64
PX-438	lb.	.5925/	.6225
Rubber Corp. of America	lb.	.5925/	.6325
Drapex 3.2	lb.	.40 /	.54
Dutch Boy NL-A10 (DBP)	lb.	.30 /	.33
-A20 (DOP), A30 (DIOP)	lb.	.305 /	.335
-A54	lb.	.295 /	.325
-C20 (DOS)	lb.	.61 /	.63
-F21	lb.	.395 /	.425
-F31	lb.	.44 /	.47
-F41	lb.	.48 /	.51
Dutrex 6	lb.	.025 /	.035
Dymerex Resin	lb.	.135 /	.1475
Elastex 36-R	lb.	.43 /	.4625
37-R	lb.	.70 /	.71
Emulphor EL-719	lb.	.52 /	.73
Endor	lb.	.67	
Ethox	lb.	.43 /	.455
Ethylene glycol, comml	lb.	.135 /	.165
Wyandotte	lb.	.1325/	.1425
Flexol 3 GH	lb.	.44 /	.46
3 GO	lb.	.53 /	.55
4 GO	lb.	.325 /	.355
10-A	lb.	.425 /	.455
426	lb.	.27 /	.30
810, 810X, 10-10, 10-10X	lb.	.305 /	.335
TPF, A-26	lb.	.435 /	.465
Flexricin P-4	lb.	.3475/	.3625
P-6	lb.	.415 /	.43
Flexricin P-8	lb.	.3475/	.3625
PG-16	lb.	.335 /	.35
Fortex	lb.	.125 /	.145
Fura-Tone NC 1008	lb.	.28	
1012	lb.	.46	
G. B. Asphaltic Flux	gal.	.097 /	.177
Naphthenic Neutrals	gal.	.125 /	.215
Process oil, light	lb.	.0275/	.0375
Medium	lb.	.0375/	[illegible]
Galex W-100	lb.	.155 /	.18
W-100 D	lb.	.1525/	.1775
Gilsowax B	lb.	.0975/	.11
Harchemex	lb.	.24 /	.285
Harflex 300	lb.	.58 /	.615
325	lb.	.4325/	.46
375	lb.	.7425/	.83
500	lb.	.315 /	.41
HB-20	lb.	.15 /	.185

MACHINERY AND SUPPLIES FOR SALE (CONT'D)

FIRST CLASS EQUIPMENT FROM YOUR FIRST SOURCE
Unused F B 14" x 30" Two-Roll Mills. Good used 2-Roll Mills, 12" x 24", 22" x 60". 3-Roll Calender 22" x 58" with accessories. 6 Southwark Presses, 36" x 36", 14" Ram. Stewart-Bolling Press 36" x 36", 22" Ram. HPM Self-Cont. Presses, 7- and 25-Ton. F-B Unused Belt Press 52" x 31'. EXTRUDERS: NRM 1½"; NRM 6" Rubber Tuber. Royle 2" Extruder; Hydraulic Strainer 15". VULCANIZERS: 6' x 16', 41" x 54", 2' x 4', others. Utility Rubber Stock Cutter with Conveyor. Baker Perkins 150-Gal. Dispersion Mixer, 150 HP. J. H. Day Mogul Mixer, 150-Gal., Vac. Cov., 75 HP. Baker Perkins 5-gal. Dispersion Mixer, 30 HP. Banbury #9: J. H. Day 40-gal. Pony Mixers. Inquire about the FMC Rental-Purchase Plan. FIRST MACHINERY CORP., 209-289 Tenth Street, Brooklyn 15, New York. Phone ST 8-4672. Cable "Effemcy."

FOR SALE: 1—6" x 16"—2-ROLL MILL; 1—8" x 18"—4-ROLL calender; 1—24" x 24" Erie 6-opening press, 20" ram; 1—6" x 12"—3-roll lab. calender. CHEMICAL & PROCESS MACHINERY CORP., 52 9th Street, Brooklyn 15, N.Y. HY 9-7200.



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ORIGINAL SHORE
DUROMETER
ASTM D676 AND ASTM D1484

Various models for testing the entire range of hardness from elastomeric to rigid. Available in quadrant or round dial case. May be used free hand or on table top OPERATING STAND WITH DEAD WEIGHT (left).

THE SHORE INSTRUMENT & MFG. CO., INC.
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96 END HORIZONTAL FOUR SHUTTLE LOOM

Special Machinery
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Laboratory Equipment
Tire Molds
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Extrusion Dies

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MACHINE and MOLD, Inc.
384 GETTY AVENUE,
CLIFTON, NEW JERSEY

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There's not another rotary joint like the Johnson Type SN. Used where inlet or outlet pipe must rotate with the roll—on certain paper machines, drilled rolls of rubber or plastic mills and calenders, double shell dryers, and the like. Needs no external supports of any kind. Like all Johnson Joints the Type SN seals without packing, needs no lubrication or adjustment.

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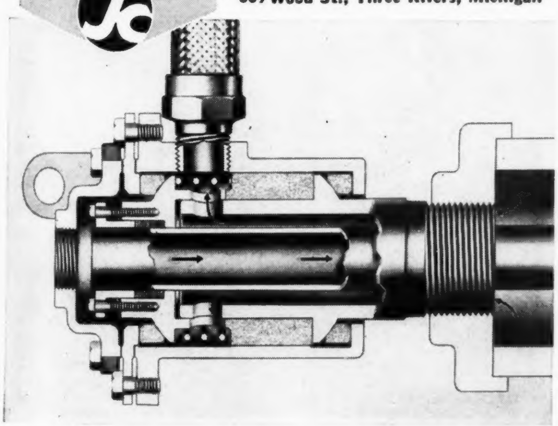
THE JOHNSON CORPORATION
869 Wood St., Three Rivers, Michigan



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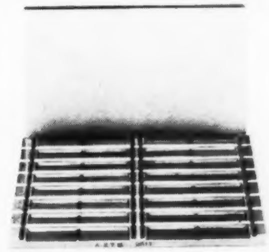
Designed to ASTM Standards or YOUR Specifications



D813, Fig. 3
DeMattia,
Flex Test.

ANOTHER HOGGSON MOLD

Designed for a Specific Need

D813, Fig. 3 DeMattia Flex Test was designed to answer a specific problem. Hoggson engineers are known throughout the world for reputable service in supplying manufacturers of rubber, plastic and synthetic products with precision molds and dies for test samples or actual production. Send your requirements for Hoggson's suggestions. Ask for literature.

HOGGSON & PETTIS MFG. COMPANY
141-S Brewery St., New Haven, Conn.

HB-40	lb.	$0.19	$0.23
Heavy Resin Oil	lb.	.0225	.0375
HSC-13	lb.	.25	.32
-39	lb.	.22	.29
Hycar 1312	lb.	.60	
Hypalon Peptizer H-20	lb.	1.59	
Kapsol	lb.	.33	.355
Kenflex A, L	lb.	.26	.27
B	lb.	.23	.24
N	lb.	.18	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.325	.335
-90	lb.	.40	.44
-140	lb.	.46	.485
-201	lb.	.46	.475
-260	lb.	.34	.38
Kronisol	lb.	.35	.385
Kronitex AA, I, K-3, MX	lb.	.325	.36
LX-685, -125, -135	lb.	.125	.135
Marvinol plasticizers	lb.	.28	.8825
Methox	lb.	.39	.425
Millrex	lb.	.15	
Monoplex S-38	lb.	.215	.24
S-71	lb	.45	.475
Morflex	lb.	.25	.65
Natac	lb.	.1685	.1785
Neoprene Peptizer P-12	lb.	1.18	
W-9	lb.	2.28	
Nevillac	lb.	.31	.85
Neville R Resins	lb.	.145	.205
Nevinol	lb.	.24	
No. 1-D heavy oil	lb.	.065	
NP-10	lb.	.44	.48
ODA (octyldecyladipate)			
Good-rite GP-235	lb.	.40	.55
Kessoflex	lb.	.40	.435
RC	lb.	.40	.44
ODP (octyldecylphthalate)			
Good-rite GP-265	lb.	.29	.445
Hatco	lb.	.305	.335
Rubber Corp. of America	lb.	.265	.305
Ohopex Q-10	lb.	.275	.315
R-9	lb.	.3525	.3775
Orthonitro benzophenol, comml.	lb.	.13	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185	.225
Panarez Resins	lb.	.09	.14
Para Flux, regular	gal.	.10	.2125
No. 2016	gal.	.165	.24
2332	gal.	.11	
4205	lb.	.1075	.2125
Para Lube	lb.	.46	.48
Resins	lb.	.04	.045
Paradene Resins	lb.	.07	.08
Paraplex 5-B	lb.	.29	.3475
AI-111	lb.	.32	.3275
G-25	lb.	.76	.77
-40	lb.	.4825	.51
-50	lb.	.39	.4175
-53	lb.	.4325	.46
-60	lb.	.325	.35
-62	lb.	.345	.37
RG-7	lb.	.33	.335
-8	lb.	.505	.5125
-10	lb.	.52	.5275
Pepton 22	lb.	.83	.86
65	lb.	1.23	1.26
65-B	lb.	.83	.86
Philrich 5	gal.	.125	
Picco Resins	lb.	.09	.17
480 Oilproof Series	lb.	.18	.23
Aromatic Plasticizers	lb.	.075	.095
Liquid Resin D-165 (Y)	lb.	.06	.075
(Z-3)	lb.	.07	.085
(Z-6)	lb.	.08	.095
S. O. S.	gal.	.29	.34
Piccocizers	lb.	.05	.07
Piccolastic Resins	lb.	.21	.27
Piccolyte Resins	lb.	.205	.245
Piccopale Resins	lb.	.12	.135
Piccovars	lb.	.165	.20
Piccovol	lb.	.025	.038
Pictar	gal.	.25	.40
Pigmentar	lb.	.046	.0634
Pigmentaroil	lb.	.046	.0634
Pitch, Burgundy, Sunny South	lb.	.103	.1085
Pitt-Consol 500	lb.	.28	.305
640	lb.	.42	
Plasticizers			
42	lb.	.34	.40
84	lb.	.26	
B	lb.	.35	.45
DP-520	lb.	.435	.455
MP	lb.	.035	.0755
MT-511	lb.	.6925	.7425
ODN	lb.	.35	.475
SC	lb.	.38	.55
Plastoflex #3	lb.	.52	.57
#520	lb.	.36	.435
DBE	lb.	.50	.55
MGB	lb.	.29	.37
SP-2	lb.	.43	.48
VS	lb.	.3575	.3975
Plastogen	lb.	.0875	.09
Plastone	lb.	.25	.32
Polycin 470	lb.	.325	.34
Polycizers	lb.	.25	.415
162	lb.	.25	.405
Polymel-C	lb.	.1775	.1875
C-130, DX	lb.	.1375	.1475
D	lb.	.225	.235
D-TAC	lb.	.1975	.215
Poly-Sperse AP-2	lb.	.23	.295
Poly-Sperse AP-300	lb.	$0.26	$0.325
LC-20	lb.	.26	.325
R-100	lb.	.17	.235
PT Pine Tars	lb.	.044	.063
101 Pine Tar Oil	lb.	.044	.063
RC Plasticizer PR	lb.	.28	.43
Reogen	lb.	.1425	.145
Resin C pitch	lb.	.0225	.031
R6-3	lb.	.38	.40
Resinex 10, 25, 50, 110	lb.	.04	.045
70	lb.	.0325	.0375
85, 100	lb.	.035	.04
115	lb.	.0375	.0425
L-2, L-3, L-4, L-5	lb.	.0225	.03
Rosin Oil, Sunny South	gal.	.58	.76
RPA No. 2	lb.	.85	
3	lb.	.51	
Conc.	lb.	.85	
6	lb.	1.66	
RSN Flux	gal.	.10	.91
Rubber Oil B-5	lb.	.0225	.0355
Rubberol	lb.	.18	.2725
Santicizer 1-H	lb.	.50	.52
8	lb.	.43	.47
9	lb.	.42	.44
140	lb.	.325	.36
141	lb.	.34	.375
160	lb.	.26	.30
409	lb.	.39	.42
603	lb.	.255	.295
B-16	lb.	.46	.49
E-15	lb.	.5225	.5525
Santocizer	lb.	.4275	.4575
Sebacic acid, purified, comml.	lb.	.59	.65
Binney & Smith	lb.	.64	.76
C. P.-Binney & Smith	lb.	.72	.84
Harchem	lb.	.655	.815
Sherolatum Petroleum	lb.	.05	.10
Softener #20	gal.	.10	.20
Special Rubber Resin 100	lb.	.1675	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61	.635
Syn-Tac	gal.	.33	.635
Synthol	lb.	.17	.2625
Tetraflex R-122	lb.	.255	.29
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	
Triacetin	lb.	.37	.41
Tributyl phosphate	lb.	.50	.535
Tributyrin	lb.	.69	
Tricresyl phosphate, comml.	lb.	.33	.36
Monsanto	lb.	.325	.36
Naugatuck	lb.	.33	.36
PX-917	lb.	.33	.36
Triphenyl phosphate, comml.	lb.	.39	.40
Monsanto	lb.	.415	.435
Turgum S	lb.	.156	.166
SB	lb.	.105	.115
Turpol NC 1200	lb.	.61	.70
Tysonite	lb.	.3025	.305
United	gal.	.69	1.20
X-1 Resinous Oil	lb.	.0225	.0325

Reclaiming Oils

Bardol, 639	lb.	.0275	.0375
B	lb.	.055	.065
BRH 2	lb.	.0213	.0351
BRT 3	lb.	.02	.031
4	lb.	.02	.031
7	lb.	.035	.036
BRV	lb.	.0625	.065
Burco-RA	lb.	.053	.0805
BWH-1	lb.	.16	.17
Dipolymer Oil	gal.	.33	.48
Dispersing Oil No. 10	lb.	.06	.0625
G. B. Oils	gal.	.115	.275
Heavy Resin Oil	lb.	.0225	.0375
LX-572	gal.	.27	.32
-759	gal.	.1375	
-777, -809, -859	gal.	.23	.33
-869	gal.	.33	.43
-871	gal.	.34	.44
No. 3186	gal.	.28	.295
Picco 6535	gal.	.25	.30
C-33	gal.	.215	.385
-42	gal.	.23	.40
D-4	gal.	.27	.44
E-5	gal.	.25	.35
Q-Oil	gal.	.286	.36
Pitt-Consol 500	lb.	.28	.305
640	lb.	.42	
PT 101 Pine Tar Oil	gal.	.038	.0554
Reclaiming Oil #3186	gal.	.28	.385
-G	gal.	.25	.365
4039-M	gal.	.3275	.3975
-Y	gal.	.30	.37
RR-10	lb.	.37	
S. R. O.	lb.	.015	.0225
X-1 Resinous Oil	lb.	.0225	.0325

Reinforcers, Other Than Carbon Black

Angelo Shellacs	lb.	.485	.7325
Borden, Chem. Div.			
Arcco 978-42B	lb.	.18	.19
1073-18B	lb.	.135	.145
1294-36B	lb.	.115	.125
1301-12B	lb.	.15	.16
BRC-20	lb.	.0235	.0245
22	lb.	.026	.0285
30	lb.	.0165	.025
521	lb.	.023	
Bunarex Resins	lb.	.085	.095
Cab-o-sil	lb.	.66	1.45
Calcene CO	ton	105.00	125.00
NC	ton	80.00	100.00
TM	ton	82.50	102.50
Car-Bel-Rez C	lb.	$0.126	$0.145
Clays			
A. F. D. Filler	ton	29.50	36.00
Aiken	ton	14.00	
Albacar	ton	50.00	55.00
Buca	ton	45.00	
Burgess Iceberg	ton	50.00	80.00
Icecap K	ton	65.00	90.00
Burgess Pigment #20	ton	35.00	60.00
#30	ton	37.00	60.00
Catalpo	ton	35.00	
Champion	ton	14.50	
Crown	ton	14.00	33.00
Dixie	ton	14.50	15.00
Franklin	ton	13.50	35.25
GK Soft Clay	ton	11.00	
Harwick	ton	21.50	77.00
Hi-White R	ton	10.00	14.50
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
L. G. B.	ton	13.00	17.50
L. G. P.	ton	15.50	20.00
McNamee	ton	14.50	15.00
RX-43	ton	33.00	
Natka 1200	ton	13.00	
Par	ton	13.00	13.50
Paragon	ton	10.00	14.50
Pigment No. 33	ton	37.00	
Polyfil C	ton	25.00	
F	ton	45.00	
X	ton	30.00	
40	ton	40.00	
70	ton	53.00	
80	ton	65.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	10.00	14.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00	30.00
Witco No. 1	ton	14.00	30.00
No. 2	ton	13.50	30.00
Clearcarb	lb.	.1175	.1255
Cumar Resins	lb.	.095	.19
Darex Resins	lb.	.42	.49
DC Silica	lb.	1.15	1.40
Diatomaceous silica	ton	32.00	48.00
Good-rite 2007	lb.	.36	.38
2057	lb.	.30	.31
Hi-Sil 233	lb.	.0825	.0975
X303	lb.	.40	.45
Hycar 2001	lb.	.55	
2007	lb.	.39	
Indulins	lb.	.06	.08
Kralac A-EP	lb.	.43	.54
Laminar	ton	30.00	
Magnesium carbonate			
DCI	lb.	.11	
Magcarb L	lb.	.11	.14
Marbon Resins	lb.	.36	.43
Multifex MM	ton	117.50	137.50
Super	ton	167.50	187.50
Neville Resins			
465	lb.	.075	.08
LX-509	lb.	.33	.35
Nebony	lb.	.045	.05
Paradene	lb.	.07	.08
R	lb.	.145	.205
Para Resins 2457	lb.	.04	.045
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.0850	.19
Piccolyte Resins	lb.	.2225	.2525
Piccoumaron Resins	lb.	.0875	.19
Piccovars	lb.	.145	.20
Pliolite NR types	lb.	.98	1.33
S-3	lb.	.42	.49
-6	lb.	.36	.43
B	lb.	.36	.43
E	lb.	.36	.43
Plio-Tuf G85C	lb.	.52	.59
Purecal M	ton	56.75	71.75
SC, T	ton	110.00	125.00
U	ton	120.00	135.00
R-B-H 510	lb.	.15	.22
Resinex	lb.	.0375	.0525
Rubber Resin LM-4	lb.	.28	.35
Silene EF	lb.	.06	.07
L	lb.	.0625	.0725
Silvacons	ton	55.00	85.00
Transphalt	lb.	.0375	.0575
Witcarb P	ton	117.50	153.50
R	ton	127.50	163.50
Regular	ton	60.00	96.00
Zeolex 23	lb.	.06	.07
Zinc oxide, commercial†	lb.	.145	.155

Retarders

Benzoic acid TBAO-2	lb.	.44	
Good-rite Vultrol	lb.	.62	.66
R-17 Resin	lb.	.1075	.36
Retarder ASA	lb.	.57	
E-S-E-N	lb.	.39	.41
J	lb.	.68	.70
PD	lb.	.39	.41
W	lb.	.46	
Retardex	lb.	.47	.50
Thionex	lb.	1.14	
Wiltrol P	lb.	.37	.39

Solvents

Bondogen	lb.	.555	.605
Butyrolactone	lb.	.60	.65
Cosol #1	gal.	.37	.43
#2	gal.	.42	.48
Dichloro Pentanes	lb.	.04	.07

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Dipentene DD, Sunny South	gal.	$0.42 /	$0.63
Ethylene dichloride, comml	lb.	.09 /	.122
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsolv H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34
Penetrell	gal.	.42 /	.63
Picco Hi-Solv Solvents	gal.	.16 /	.48
Pine Oil DD, Sunny South	lb.	.15	
Skellysolve-B	gal.	.17	
-C	gal.	.162	
-H	gal.	.148	
-R, -V	gal.	.139	
Stauffer Carbon Disulfide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

Tackifiers

Actinol DLR	lb.	.0625/	.085
Bardol, 639	lb.	.0275/	.0375
Borden, Arcco			
A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
BRH 2	lb.	.0213/	.0351
Bunarex Resins	lb.	.065 /	.1225
Bunaweld 480	lb.	.24	
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.095 /	.19
Galex W-100	lb.	.155 /	.17
W-100D	lb.	.1525/	.1625
Indopol H-35	gal.	.65 /	.84
H-50	gal.	.70 /	.89
-100	gal.	.85 /	1.08
-300	gal.	1.00 /	1.24
-1500	gal.	1.48	
L-10	gal.	.40 /	.59
-50	gal.	.45 /	.64
-100	gal.	.55 /	.74
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.1685/	.1785
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.0875/	.19
Piccolastic Resins	lb.	.21 /	.27
Piccolyte Resins	lb.	.2225/	.2525
Piccopale Resins	lb.	.089 /	.13
Piccoumaron Resins	lb.	.0875/	.19
R-B-H 510	lb.	.15 /	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	26 /	.3025
United	gal.	.69 /	1.20
Vistanex, LM grades	lb.	.45	

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Di-Cup	lb.	1.10	
Dodecenyl succinicanhydride	lb.	.75 /	.76
HMDA-Carbamate	lb.	4.50 /	4.90
Ko-Blend I, S	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525/	.38
DCI	lb.	.215 /	.235
601	lb.	.2525	
Maglite D, K, Y	lb.	.2525/	.28
M	lb.	.27 /	.30
Marmag	lb.	.23 /	.265
Michigan No. 1782	lb.	.2525/	.30
PSD 85	lb.	.37 /	.50
Red Lead (*See Accelerator-Activators, Inorganic*)			
Seamag	lb.	.20 /	.22
Sulfasan R	lb.	1.55	
Sulfur flour, comml.	100 lbs.	2.55 /	3.30
1018	lb.	.12 /	.1575
Aero	100 lbs.	2.40 /	7.75
Crystex	lb.	.195 /	.23
Insoluble 60	lb.	.125 /	.13
Rubbermakers	100 lbs.	2.65 /	4.55
Stauffer	lb.	.0265/	.054
Telloy	lb.	4.00	
VA-7	lb.	.50	
Vandex	lb.	7.00	
Vultac No. 2	lb.	.47 /	.74
3	lb.	.51 /	.78
White lead silicate (*See Accelerator-Activators, Inorganic*)			

Synthetic Rubbers

(Continued from page 102)

Philprene 6700	$0.175[b] /	$0.181[b]
Plioflex 1703, 1773	.206[c] /	.212[c]
1710C, 1712C	.1885[c]/	.1945[c]
1713	.175[c] /	.181[c]
1714C	.1725[c]/	.1785[c]
1773	.206[c] /	.212[c]
1778	.191[c] /	.197[c]
Polysar Krynol 651		.1885[c]
652		.191[c]
S-1703		$0.195[a]
-1707		.18[a]
-1709, -1710, -1712		.1775[a]
-1778		.18[a]
Synpol 1703	$0.206[b] /	.212[b]
1707, 1708	.191[b] /	.197[b]
1712	.1885[b]/	.1945[b]
Synpol 8200	.191[b] /	.197[b]
8201, 8208	.175[b] /	.181[b]
8202	.1725[b]/	.1785[b]

Cold SBR Oil-Black Masterbatch

Ameripol 1805	.155[c] /	.161[c]
1808	.148[c] /	.154[c]
1809	.1545[c]/	.1605[c]
1810	.140[c] /	.146[c]
4756	.1545[c]/	.1605[c]
4758	.145[c] /	.151[c]
4759	.1598[c]/	.1658[c]
4760	.1576[c]/	.1636[c]
4761	.171[c] /	.177[c]
B-142		.1515
Baytown 1801		.176[b]
1803		.174[b]
1811		.1569[b]
8775		.1545[b]
8776		.1679[b]
8777		.1550[b]
8778		.148[b]
8779		.1496[b]
8780		.1507[b]
8781		.1655[b]
8782		.1583[b]
8783		.1515[b]
Carbomix 1809, 1814		.1545[c]
1813		.164[c]
1808		.148[c]
1815		.1496[c]
1817		.1715[c]
3761		.1576[c]
3764		.1685[c]
Gentro-Jet 9250		.158
9251		.164
Gentro-Jet 9252		.167
9275		.150
OB-102		.1825[a]
-104		.1475[a]
-110		.141[a]
Philprene 1803	.174[b] /	.18[b]
1805	.155[b] /	.161[b]
1808	.148[b] /	.154[b]
6753	.1496[b]/	.1556[b]
6755	.1715[b]/	.1775[b]
S-1800		.1475[a]
-1802		.141[a]
-1803		.165[a]
-1806		.151[a]
-1807		.154[a]
-1808		.142[a]
Synpol 8253	.1584[b]/	.1644[b]
8254	.1545[b]/	.1605[b]
8255	.148[b] /	.154[b]
8267	.164[b] /	.17[b]

Cold SBR Rosin Masterbatch

Copo 3900	.231[c] /	.237[c]

Cold SBR Latex

CL-101		.28[a]
Copo 2101		.30[c]
2102, 2105, 2110		.32[c]
2108		.30[c]
2109		.2775[c]
3852	.30[a]	
FR-S 2105	.32[c] /	.366[c]
Naugatex 2105, 2107	.32[a] /	.38[a]
2108	.30[a] /	.38[a]
2113	.29[a] /	.36[a]
Pliolite Latex 2101		.30[c]
2105, 2107		.32[c]
2108		.30[c]
Polysar Latex 721		.32[c]
S-2101		.26[a]
-2105		.28[a]
-2107		.32[a]
-2108		.29[a]

Misc. SBR

FR-S-110 (latex)	.3000[c]	
-150 (latex)	.3000[c]	
-174 (latex)	.2950[c]	
-176 (latex)	.2775[c]	
-182	.241[c] /	.247[c]
-184	.1885[c]/	.1945[c]

Urethane Types

Adiprene L, LD-167, -213	1.15	1.65

■

Bayer Expands

(Continued from page 93)

blends of NBR and poly(vinyl chloride).

Bayer has also introduced a new grade of Vulkollan, a urethane elastomer produced by the casting method and characterized by resistance to heavy loads. The new grade, Desmophen A, is said to have good storage stability. It can be processed on a mill, and final crosss-linking is carried out with slowly reacting isocyanates.

Quantity production has also started on Urepan E, a new urethane elastomer which can be cross-linked with peroxides and can be processed by normal methods. Previously it was produced only on a pilot-plant basis.

Some time this year the company will start pilot-plant production of new ethylene vinyl acetate polmyers, which can be processed both as thermoplastics and as cross-linking elastomers which give vulcanizates with resistance to light and ozone, color stability, and compatibility with other elastomers.

Bayer also plans manufacture on a large scale of polyisoprene and polybutadiene, using recently developed catalyst systems.

Pelletized News

Soviet specialists are reportedly building a plant for Brazil to exploit the rich deposits of bituminous shale of the Paranaiba River area. Daily output of more than 35 million cubic feet of gas is expected, with future plans including manufacture of rubber, polyethylene, and other products from this raw material.

CIA BRASILEIRA DE ARTEFACTOS DE BORRACHA, Brazilian rubber manufacturing firm, will import equipment, valued at DM. 1,300,000, from West Germany for its tire factory.

The Congo clone, Y3/46, yielded just over two metric tons, dry rubber, per hectare (about 1,800 tons per acre) in 1959. This yield was realized in comparative tests with various clones which were begun in 1943 and was revealed in the 1959 report of the Congo Institute for Agricultural Research. The trees were 15 to 16 years old and were planted at an average density of 294 trees per hectare (about 2.47 acres).

RUSSIA has contracted with Dunlop Rubber Co. to supply 6½ miles of specially designed conveyor belting intended to carry heavy ore, it is reported. The belting, made with duck woven from 100% synthetic fiber, is to have very high tensile strength; it will be more than 6½ feet wide and more than an inch thick. The largest individual belt will weigh about 10½ tons.

When the new carbide factory of VEB Chemische Werke Buna, Schkopau, East Germany, begins operations in 1961, an increase in output of carbide by 270,000 tons annually is expected. This will make Buna Werke the world's largest producer of carbide. This rise in capacity will allow production of synthetic rubber to be increased by 18,000 tons to 100,000 tons by 1965. Considerable expansion in the plastics field is also anticipated.

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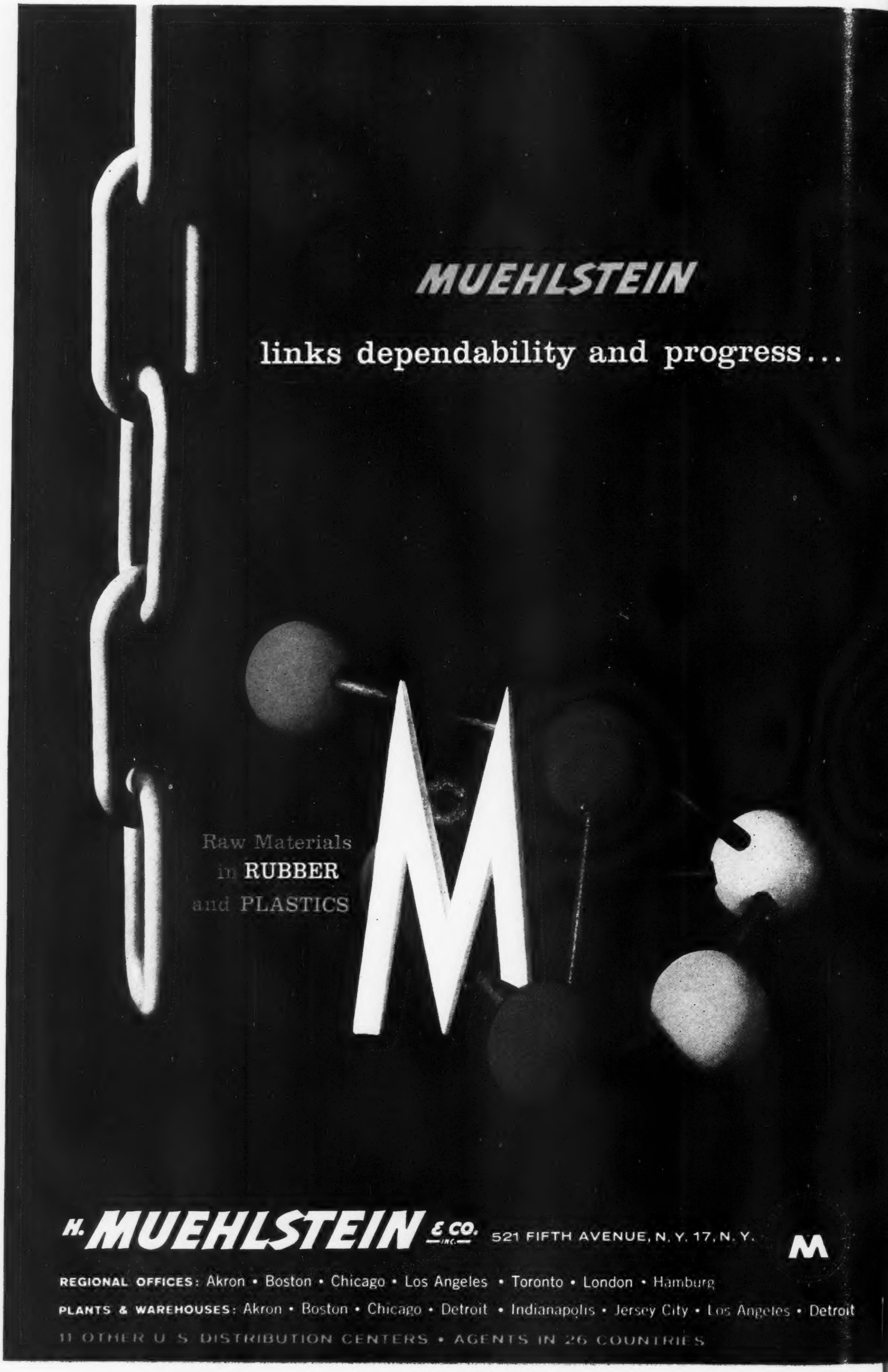
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